MEXICO.

Her Public Works and People.

Written for Engineering News:

What Mexico has done should excite more general interest with our countrymen than speculation regarding its future. For, in the most imaginary case of her future development, drawn from the dreams of the American speculator, there would be no danger of menace to our border, and there is no general desire of our people to take territory from her. Their laws, customs, people, are of a different kind from ours, and no result that has been worked out with us can be applied to them. The desire will probably be, when the present invasion has subsided, to encourage her growth by good will and friendly offices, but not to flood her territory with money, material and skilled labor, with the hope of seeing her at once regenerated. Its recorded past reaches back into the centuries, and what cannot be traced might make it contemporary with Greece and Rome. Its age alone, however, forms its least title to our respect, but this is filled with scientific discovery, high and successful patriotism, mechanical dexterity and energy, that we look in vain for now in their ancient degree of excellence among the race of to-day. We know this from her history that is written, and we know it from the testimony of her ruins. The remark of a distinguished foreigner who once visited our land, "that we were fortunate in having no ruins," should be a source of pride to us Americans. Our life is in that of to-day, and our best history is almost comprised within the recollection of living men; but to have a past is better than to have nothing, and her mountain scenery is all that Mexico has which has not deteriorated.

The valley of Mexico called in old times Anahùac is to the country what the part of Hamlet is to the play. A wide spreading plain with mountains surrounding it, and towering far above the general range, the twin snow-clad summits of Ixtacihnatl and Popocatepetl like sentinels guarding the valley. This was of old thought to be the garden spot of the land as it is to-day, for in about the year 600 the Toltecs came and chose it for a settlement, grew and flourished till near the twelfth century, when a famine so decimated them, that the few left migrated on the approach of the fierce Aztecs. From whence either of these people came, we have nothing to inform us. The Toltecs left the pyramids that are near the Verra Cruz Railroad and are supposed to have started the arts practiced by the Aztecs, the most remarkable of which was their method of chronology, being the most perfect in use at that time of any nation. They added twenty-six days for every one hundred and four years, and by this system could not lose a day for five centuries. The Aztecs improved upon what they learned from the Toltecs, and held the greater portion of the central Mexico of to-day, extending to the ocean on either side, and thus were constituted at the time of the Spanish conquest in 1519. The general features of ancient Mexican history have been hastily sketched that seem to bear upon the subjects I will lightly treat of in this article. The public structures and works of Mexico and her national traits as comprising the former will be considered, the Desague of Huehuetoca, the churches, bridges, aqueducts, monuments and the Verra Cruz Railroad. The many railroads now projected or being built, it is thought, are sufficiently described in the daily papers, besides not being completed, they cannot be treated as now existing.

Sections of the Desague de Huehuetoca

An account of the famous drain or canal called Desague Real de Huehuetoca, may be interesting at this time as it would be considered in connection with any scheme undertaken to drain the valley; a work that must be done sooner or later, both to redeem the land and for comfort and convenience to the city. It is reported that parties in New York are endeavoring to incorporate or form a company for this purpose. Much of the information contained in this account of the Desague is obtained from the celebrated work of the Baron de Humboldt, published in the French language in the year 1808, called "New Spain." It may be said to be the only work of an acknowledged scientific reputation that has ever appeared relating to Mexico, and I have in vain looked for maps elsewhere, so elaborate and accurate. Four great lakes occupy nearly one-tenth of the whole area of the valley with areas and elevations as follows:

	AREAS SQUARE LEAGUES.	MEAN ELEVATIONS. METRES.
Tezcuco	10 1/8	0
Xochimilco and Chalco	6 1/8	1.11
San Cristobal	3 1/8	3.56
Zumpango	1 1/8	7.50

These lakes are given above with their elevations referred to Tezcuco, the lowest point of the valley. Next comes the City of Mexico, the Plaza de Armas or grand square, of which was at the beginning of this century 1.21 metres higher than the average level of Tezcuco. Since then the lake has slowly subsided, and now the average height is said to be about 2 metres. Into the lakes flows innumerable rivers, but there is none flowing out. So the valley was made a basin, with no natural drainage. All the lakes have in connection with them, and are divided by artificial dikes, to prevent inundation of the capital, built at various periods, some of very ancient origin. The old city, on the site of the present one, called Tenochtitlan, was built something like Venice. Three great roads, in the form of dikes, leading from the surrounding country to its centre; but in all other directions the only approach was by water, the lake of Tezcuco surrounding it. At times even these roads would be overflowed, which led the Indians to devise methods for preventing the inundations. The floods usually came from the River Cuantitlan which swelling from the rains, poured an additional volume into the lake Zumpango, causing it to overflow into San Cristobal. This lake in turn flowing into Tezcuco which flooded the streets of the city. In early times the Indians built a dike between San Cristobal and Tezcuco, thinking to keep back the rise of the former. During a long period following the conquest,—a new city having taken the place of the old one, the inundations, at intervals, continued to occur, sometimes lasting but a few days, not infrequently much longer, and once for five years. Dikes were at first resorted to after the manner of the Indians, but this availed but little.

In 1607 the Viceroy Marquis de Salina; employed an engineer named Enrico Martinez to devise some plan for relieving the Mexican Lakes of their superfluous water. Martinez after a survey and examination of different routes, (his work seems to have been accurate by the testimony of later scientists) presented two plans, one for making an outlet for the three lakes Tezcuco, San Cristobal, and Zumpango and the other for the Lake of Zumpango alone, which of course included the River Cuantitlan, spoken of before and mainly considered as the cause of the inundations, a belief to a great extent true, though the city has been flooded from Chalco and Xochimilco alone. The plans designed that the drainage should be done by a subterraneous gallery between the mountains of Sincoque and the hills of Nochistongo, as being the narrowest and least elevated of any place in the surrounding mountains. From the plan it would seem that the brook or aroyo of Tequisquiac, would have been chosen, as the natural place for drainage, but it is described as of narrow breadth, and perhaps its enlargement, would have been more costly than the scheme followed, considering that a tunnel, not a trench, was contemplated by the plan.

*The northern part of San Cristobal is often called Xaltocan.

*The leagues are 25 to the equatoral degree or of a length in miles 2¾ (about). The metre is about 39 inches, or more exactly 3-2607 feet. The point I give because it is the ordinary lineal measure for long distances used in Mexico. The latter because it is the lately adopted leagal measure.

Still in the following years when a trench became a necessity it was considered and advocated, which I shall allude to further on. The plan including only the River Cuantiltan and the Lake Zumpango was adopted. The gallery was begun in November of the year 1607 and was pushed with such vigor that in eleven months it was completed, 15,000 Indians were employed upon it, its construction being conducted from a number of headings, from sunken shafts at the same time. Its dimensions were:

Length.....6,600 meters (4 1/10 miles.)
Breadth.....3 5/10 metres.
Height.....4 2/10 "

At the end of this gallery an open trench was made 8,600 meters in length (7 miles), conducting the water to the cascade Salto, and then by the natural drainage they flowed into the river Tula or Moctezuma. The saddest part remains to be told. The earth worked through, was a volcanic composition called *tepetate*, a material underlying most of the table land, just beneath the top soil. When dry, it varies in hardness from soft stone to clay; when wet, it is soft and slippery. The gallery not being lined, the sides and top began to crumble. First planks and props were introduced, and eventually an arch and walls of masonry, but no foundation, which naturally made the matter worse. What the ordinary engineering youth of to-day would have known, this justly renowned engineer neglected to perform—to place an inverted arch in the bottom for a foundation. The gallery entirely choked up. It was then disputed for several years, whether it was best to make the gallery larger; to build a new one lower down, and take in Tezcuco, or to make the one existing into an open trench. The latter was decided upon and took nearly two centuries to complete.

The work was enormous. The total length of the desague, from the sluice leading to Zumpango, is 20,585 metres (12 4/5 miles). 800 metres of this distance is 45 to 60 metres in depth, with a width on top of from 85 to 110 metres. 3,500 metres in length is from 30 to 50 metres in depth.* The desague was completed in 1789, to the width of the old canal of Martinez. The work was not done continuouly. When the city seemed to be in danger it would be pushed, and when the immediate peril was over it would slacken or stop. Many other schemes were proposed and considered during this long interval, and one was even entered upon, but abandoned after a little had been done; it was this. As before mentioned, the brook Tequisquiac heads in the northern part of the valley. One Simon Mendez maintained that the ground of the valley rose considerably on the northwest side towards Huehuetoca; that the point chosen by Martinez was the mean level of the most elevated lake—Zumpango, and not that of the lowest—Tezcuco; that the ground falls considerably to the north of the village of Carpio, east from the lakes of Zumpango and San Cristobal. He proposes to lower Tezcuco, by a gallery passing between Xalticas and Santa Lucia and open into the brook Tequisquiac.

Towards the close of the last century, canals were made from Zumpango and Cristobal to the desague. It was hardly remembered when constructing the first one, that a similar one had been made by Martinez nearly two centuries before. As the desague seemed at this later period, to only have been contemplated as an outlet for the River Cuantitlan, these two canals were built with a length of about 2,300 metres and a depth of from 10 to 12 metres. Their cost was over $185,000 of our money, and the total cost of the desague, including this, was estimated at $6,500,000; but it should be remembered that the purchasing power of money was then much greater than now, and that the Indians were paid little or nothing.

At the beginning of the present century, or, to speak exactly, in 1804 a canal was projected and ordered built from Tezcuco to the desague as shown on map. It was never completed even if it was begun. The desague would have had to be deepened for a length of 10,200 metres from the sluice of Zumpango, at this point 16.2 metres, running in the shape of a wedge to zero, at the former point. This would have been an enormous work, considering that every increase of depth in the desague would have necessitated an increase of width reaching to the top. This canal would have had an elevation at the lake of Tezcuco of 0.76 metres below its mean level. Therefore, reducing the surface of the lake to that extent, the fall of the canal would have been 0.2 metres to 1,000. The plan of Martinez for making a similar canal was rejected in 1607 (which was feasible considering that he never contemplated making an open ditch in the place of the gallery), because it was thought he allowed too little fall. In the opinion of these ignorant authorities, half-a-metre to the hundred, was considered necessary for the flow of water. The Mexican Central Railroad now follows the side of the great desague as it climbs out of the valley.

*Specimen sections are shown on map.

The churches will bear close examination and are *par excellence* the finest buildings architecturally, and in workmanship, within the republic. The most elaborate in size and decoration is the cathedral, in the grand square of the capital, built on the site and from the ruins of the Aztec temple of Huitzilopochtli, the war god. It is not very much superior to what is found in many of the inland cities. They are mostly built on one general plan—that of St. Paul's at London, with a dome above the altar, and twin towers over the entrance to the nave, except that in St. Paul's the steeples are made subordinate to the dome while in the Mexican cathedral the dome is less prominent than the towers. The cities usually contain but one church of prominence, the others are so insignificant in comparison, as hardly to show in the landscape, and in the landscape they are particularly displayed to advantage; the cities usually being built in valleys. The twin towers form the goal and landmark to many a weary traveler, as they are seen hours often, before they are reached, on horse-back or in diligence. I have said the church architecture is similar, but would not give the impression that one is copied from another; the details are ever varying. The building material is stone. A heavy balustrade surrounds the structure and a magnificent flight of steps leads up to the entrance. They were built in the time of the Spaniards from a heavy tax laid on the produce of the land, or the mines.

The bridges are next in importance to the churches as examples of architecture. They are universally built of stone in the form of arches, very pretty in design, and in their masonry well executed. In a landscape jardinere view, they might well be said to fit the landscape. It seems as if the streams were made to run through them, rather than that they were built to cross the rivers. I will give an account of what can be often seen there, which I think will bear out this statement. A road descending into and crossing a valley or ravine, with a small stone bridge of one or two arches built over a stream running through it. The bed of the stream would be but a few feet below the level of the road and would be dry for the greater portion of the year. To get height for the crowning of the arches, the ascent on to the bridge and descent from it would be very steep, so that in the wet season the water flowed around the bridge as well as under it; when it rained the bridge was not used if the stream could be forded, and when there was no water it was not used at all, but the little structure was very pretty. I often thought how this case contrasted the Mexican and American. The latter would have raised the road bed, lightening the grade into and out of the valley, and then put in culvert or bridge as efficiency and economy demanded; the Mexican never improves the roads.

Aqueducts are very frequently met with throughout the country for conducting water, though I saw but two cities having even this supply (Mexico and Queretaro). The usual way for supplying them being by jars brought in by the Indians and their donkeys. The little stone arches of the aqueducts are however often seen leading from the hills to the haciendas or farms and two lead into the City of Mexico, very low in height, a series of small heavy arches with piers that would support Bunker Hill monument. The City of Queretaro has one of a commanding height and gracefully proportioned leading from the neighboring hills across a deep ravine into the city. This structure like the bridges and churches, peculiarly enhances the scenery of the vicinity, and I shall not soon forget my first and last view of it. At nightfall after riding three days and most of the nights, a turn of the road brought us in view of the city beneath, some miles away, and this light, airy structure connecting it with the adjacent highlands.

The Mexican city has its grand square or Plaza ordinarily in front of its principal church. This space is neatly laid out with paths, and is well supplied with flowers, flowering scrubs and trees, and in its centre, either an elaborate fountain or monument. These may not be up to the highest stage of art, but they are always creditable. The City of Mexico has many monuments of excellence, and a Boulevard, that it has not been my fortune to see equaled. This leads from the Almada, a park but a short distance from the grand plaza and cathedral, to the hill and castle of Chapultepec; where the boulevard intersects the street along the Almada is the equestrian statue of Charles IV. so celebrated, and along its length are others, of Columbus and Guatemozin the last of the Aztec kings. The view of the city and mountains from the contiguous heights of Chapultepec and Guadalupe, is almost unexampled. The words of Humboldt, who was here at the beginning of this century, and soon after visited some of our own cities, pays a tribute, which has the superiority of expressing admiration, while other renowned capitals were fresh in his mind. This is his language. "It is much less from the grandeur and beauty of the monuments, than from the breadth and straightness of the streets, and much less from its edifices, than from its uniform regularity, its extent and position, that the capital of new Spain attracts the admiration of Europeans. From a singular concurrance of circumstances. I have seen successively within a very short space of time, Lima, Mexico, Philadelphia, Washington, Paris, Rome, Naples and the largest cities of Germany. By comparing together impressions, which follow in rapid succession, we are enabled to rectify any opinion, which we may too easily have adopted. Notwithstanding such unavoidable comparisons of which several, one would think, must have proved disadvantageous for the capital of Mexico, it has left in me a recollection of granduer, which I principally attribute, to the majestic character of its situation and the surrounding scenery."

The Verra Cruz Railroad leads from the city of Verra Cruz on the coast to the capital, a distance of 263 miles. Its surveys were begun about the year 1852, and after various visisitudes, the road was finished in 1873. Numerous contractors and companies were ruined before its completition. The government assisted it at times. It has now passed into the hands of the English and for the first time, has lately declared a dividend. Quantities of freight now pass over it for the building of the new railroads. This road passes through the three climatic belts of Mexico, the *tierra caliente* the warm, *tierra templada*, the temperate, and the *tierra fria*, the cold. Forty-seven miles from Verra Cruz a Fairlie is substituted for a Baldwin engine to climb to the plateau, and in the next sixty miles an ascent to 8,310 feet above the sea is made at Boca del Monte, 156 miles from the city of Mexico. Some of the grades are the heaviest I believe in the world, five per cent. that is five feet rise to the hundred, and I have seen here the rather rare construction of high bridges built on curved grade. The bridges are of iron and seem to be well made. Great care is taken topre vent accidents and at the most dangerous place a man is stationed all the time, signalling every train. The road winds along the sides of valleys and ravines; passing through innumerable tunnels, when it is too precipitous to warrant cutting out the road bed.

NATIONAL TRAITS.

I shall try, in treating of this subject, to account for the general backwardness of the country in all material prosperity. Soon after the conquest, the people became divided into three distict classes. The Spaniards, (Gachupines, as they were called) who were born in Spain; the Creoles (pure-blooded Spaniards, but born in the colony) and the Indians, that is, the native Mexicans. The first class held all the important positions of honor or trust throughout the country, in government and church, and after becoming rich, would return to Spain, and others from there, came and took their places. In this way the colony became a sort of foraging ground for the indigent members of the upper class in Spain. The soldiers who had served under Cortez, and conquered the territority, were given large allotments of lands, and so were others from Spain, less fortunate in royal favor than those who received the most remunerative places. In the course of time these people had descendants born on the soil, that might come from alliance with the Indian, when they were called Mestizos; or they might be of pure Spanish blood; the mark of distinction was no less apparent from those who had been born in Spain. This class were tyranized over to the last degree. They were taxed for the benefit of the mother country; they were not allowed to buy goods or merchandize in any place but Spain. No foreign merchant vessel could enter the Mexican ports, nor could any industry be conducted or crops even raised from the land, that interfered with the trade from the mother country. They were not allowed to have books that had not first passed the examination of the Inquisition at the capital, and were not allowed schools where secular subjects were taught, that related to history or applied science. The government of Spain directly or indirectly took the main part of the revenue extorted from the colony. Out of an annual revenue of about twenty million dollars, six went to the king of Spain and the remainder was mostly taken by Spanish officers in the colony. The third class, the Indians, were practically the slaves of the land-holders, although the name did not exist. They did all the manual labor, and were imposed upon in every conceivable way, even to being defrauded of the few theoretical rights they were supposed to have. In this way matters went on till the French Revo-

lution, and the time when Napoleon conquered Spain and made the king his prisoner—a fatal blow to the ascendancy of that country on this continent. The astonishment of all classes of Mexicans was extreme and bewildering, that such a monarch could be overthrown, and a prisoner, whom they had been taught to believe was little lower than God. The excitement was at first so great that all expressed the most devoted loyalty, and were so devoted as to invite the dethroned king to come over and become their sovereign. This feeling could be but temporary; their fear and respect subsided together; a little leven had been admitted that would ferment the whole. This manifested itself on the 16th of September, 1810, when a parish priest named Hidalgo, in the State of Guanajuato, at the head of a few Creoles and some Indians, proclaimed the independence of Mexico. His force constantly increased as he marched upon and took the cities of Celaya, Irepuate, and Guanajuato, where the most atrocious cruelties were committed on the Spanish and such Creoles as joined with them.

The revolt became quite general; talented men joined Hidalgo—many belonging to the lower order of the clergy. The rising was, however, subdued. Hidalgo marched upon, but was unable to take the capital, and was driven to the north, taken and shot. Morelos worked to the westward, and had for a time remarkable success. I particularly instance him as being the only leader who showed any marked regard for constitutional government. His great desire was to form a congress and have the power descend from it. He did establish one, a small affair, by the most liberal methods at hand, and then devoted his army to its protection. His army began to meet reverses, and was eventually completely defeated; his congress dispersed, and he was taken and shot, to the last displaying the highest personal heroism. This was in December, 1815. Morelos had prolonged the conflict much longer than the chiefs in other parts of the country, so, with his death, the cause was for a time lost, though a guerilla warfare was maintained in parts of the country. The cause for its non-success was that the Creoles did not, as a body, join with the insurgents. This was partly from fear and partly from interest, as the Spanish authorities did much to conciliate them on the breaking out of hostilities. The time was only delayed.

In 1821 the Creoles under General Iturbede rose in revolt. The Indians joined and the cause was at once successful with but little bloodshed. The capital was captured and the viceroy acknowledged the new authority. The plan was to make a Mexican monarchy with one of the royal princes of Spain as king; this plan fell through, from the royal family declining to acknowledge the independence (though they made no serious attempt to regain the country) and the Mexicans who soon met in general congress desired to have a federal republic. Iturbede soon overthrew the republic and proclaimed himself emperor. In less than a year he was banished and subsequently shot on his attempt to return. Mexico now seemed to strive in earnest for a constitutional government and H. G. Ward at this time (1825 to 1827) English Minister, writes in the most hopeful way of its future. A loan was procured from France and England (which by the way was never paid) and nothing was wanting but the right kind of character in the people to make of them a creditable nation, and give them a fair measure of prosperity, but this they did not have. It is interesting to read Mr. Ward's expressions now—he writes: "It is curious to observe how little progress was made by any of the new states after their declaration of independence until experience had taught them a sounder doctrine and led them to model their institutions upon those of the United States, which, with some modification, will in all probability be adopted ultimately by the whole of Spanish America." In 1829 Mr. Ward predicted stability to the existing government in these words: "Fourteen years of anarchy and blood-shed have brought the Mexicans to something more like unity of plan and will give stability to the system which they have adopted." * * * "The struggle like every one in which the passions of the people are engaged has been accompanied by its usual blood-shed and desolation, but humanity may console itself with the hope that the storm has now gone by and that future prosperity, however dearly purchased, will afford a compensation for all past suffering."

The history of the past fifty years has not borne out these hopes, and while our country has gone forward with such immense strides, they have gone backward. After the revolution the Mexicans continued to be divided into classes; but these were two instead of three, the Creoles and the Indians; and although the condition of the latter was somewhat ameliorated, there is still little change from of old, and from this class must come all the future prosperity, I believe, if it comes at all. This was the result of my observations there, and since my return I have seen the same idea expressed in a late work written by M. Chevalier, of Paris, who, in two octavo volumes entitled "Mexico, Ancient and Modern," attempts to justify and prove the necessity of the French intervention. He says "a subject more interesting than to penetrate into the sources of Mexican civilization, would be to know what is in the future reserved for the red race, which at this very hour forms the bulk of the Mexican population. Undoubteldy the white inhabitants of Anahuac deserve to excite the solicitude of the philosophers and of the world, but it may be held that there are qualities more original in the recesses of the mind and heart of the indigenous population; placed in other conditions they might probably assume useful destinies and supply an unexpected contingent to the general civilization."

The government is a military oligarchy under the name of a republic. The person becomes leader and president who has control of the army and can show the most force; but respect for constitutional law, such as we understand it, is not known there, and the elections are the merest farce. I consider this want of respect for law as one of the main causes for their lack of prosperity, others being; the two classes in which they are divided; the want of education in the Indian class; the large area in which the land is held, (the Indians owning none to speak of) and the deficiency in what we call character, or in the whole people.

In the ornamental industries and arts, the people naturally excell, which is shown in all their structures. The Indian house painter frescoes the ordinary houses outside and in to a degree of excellence, that we only see here in very few private residence, and the architecture of our churches tamely compare with theirs, in impressing its individuality upon the observer and the landscape. As masons they are excellent, and as workers of wood fair, but not so proficient in handling iron. One gentleman who had employed them for 30 years told me that it did not come easy to them. So as engineers, they are excellent draughtsmen, fine pensmen, but not apt to excel, where any push or energy is required; quickness to perceive and promptness to execute a rough practical scheme or structure for the occasion is not their forte. They have not the yankee trait of character which is expressed by the nautical phrase, "a long pull, and a strong pull and a pull all together."

If they were to start a project for a railroad, they would dine and wine on it, and would talk earnestly and well about the contingencies likely to arise before it would be accomplished. They would long consider those that were improbable as well as those that were probable. Our countrymen would consider the latter and go ahead.

Their politeness is universal and their hospitality unbounded. The first is shown in ways that we never see at home. I have frequently, at stopping places of the diligence, ordered a glass of wine and found their was nothing to pay; one of my fellow-passengers, without a word, had paid for it. I have stopped at the haciendas several days with a party and horses, and servants, and was told there was no charge. If there is ever to be a prosperous future for these people, it is to come from these new railroads; greater in their levelling tendencies, in their civilizing influences than school or missionary. I only doubt the nature of the material there is to work with—whether the leopard can change its spots.

LAURENCE BRADFORD.

FRICTION.—The ratio obtained by dividing the entire force of friction by the normal pressure, is called the coefficient of friction, hence we may define the unit, or coefficient of function to be the function due to a normal pressure of one pound:

Iron on oak	.62
Cast iron on oak	.49
Oak on oak, fibres parallel	.48
Do. do, greased	.10
Cast iron on cast iron	.15
Wrought iron on wrought iron	.14
Brass on iron	.16
Brass on brass	.20
Wrought iron on cast iron	.19
Cast iron on elm	.19
Soft limestone on the same	.64
Hard limestone on the same	.38
Leather belts on wooden pulleys	.47
Leather belts on cast iron pulleys	.28
Cast iron on cast iron, greased	.10
Pivots or axes of wrought or cast iron, on brass or cast iron pillows:	
1st, when constantly supplied with oil	.05
2d, when greased from time to time	.08
3d, without any application	.15

SPRINGFIELD, MASS. REPORTS.

The report of the water commissioners states that the most costly work done in the past year was the extension of the high service, done chiefly for protection from fire. The total length of the pipe laid is 11,093 feet high service, 1640 feet low service. In Main street alone, 2123 feet of high service pipe has been put down, and 1858 feet in Chestnut street; 35 high service fire-hydrants have been set and 43 in all have been added to the number owned by the city, making the present number 405. The city's mains and pipes now foot up 70.23 miles, against 67.82 a year ago. The net cost of construction in 1883 has been $18,162, against $13,545 last year. The board recommend the extension of the high service pipes on Main from Greenwood to Carew and on Bay street. The cost of maintenance was $14,860, which includes a gate-keeper's house and barn built at Ludlow; cost in 1882, $12,657. Materials and labor for new service pipes and repairs, cost $7,004 against $6,778 in 1882. The receipts were $88,642, expenditures $21,864, leaving $66,778 toward payment of interest on water bonds. Water takers have increased steadily in numbers, 257 new connections having been made. The water rents, excluding the city, amount to $82,038, double the rents of ten years ago; last year's rents, $77,406. The commissioners report that the water was of good quality during eight months of the year, and positively bad for only four days. They recommend filteration at the reservoir and mention that their well at Ludlow, which rises and falls with the reservoir, always contains good water. The average daily draught from Ludlow was 2,500,000 gallons, but in July and August it ran up to nearly 4,000,000. The commissioners think this increase was due to the use of hose, and add that if the waste is not checked another main to Ludlow will be necessary. This main would cost $400,000, while the hose receipts are only $4,761, falling far short of the interest of the investment. The water register's report states that water was turned off from 22 premises for non-payment of rent. The rainfall of the year according to Ludlow was 35.394 inches; at the armory 38.68 inches.

The superintendent of streets reports the building of four new streets—Adams, Clarendon, Hillman, and Dale avenue—with a length of 3,407 feet. There have been 9,184 feet of sidewalks built, and 55 cross-walks and 8,802 feet of curbing have been put in. The cost of obtaining macadam has been $2.18 per cubic yard. The city has used 2,674 cubic yards of macadam during the year and now owns 826. The steam heating company's expansion boxes are declared to be a nuisance, as being so near the surface that they dry the moisture in the cementing of the macadam, leaving dry stones to be picked up by the hoofs of the horses. The frequent digging up of the steam joints and expansion boxes without regard to the condition of the streets should be stopped. Such repairs could be done in the spring before the streets have been leveled and repaired, instead of waiting till October. The nuisance created by the steam pipes on Main street, makes it a serious question whether the public convenience and necessity does not require their removal to a less obejctionable location. It is suggested that as the main sewer and double horse-car track have now been built on Main street, the macadam should be replaced with something more substantial, and it is recommended that the west side of the street from the Boston and Albany Railroad to Bridge street be paved with granite blocks. In grading and gravelling, aside from ordinary repairs, $11,300 have been spent and as much more is needed for 1884. The sum of $2,451 has been spent of $3,500 given the city to raise the Birchen Bend road. Almost all the bridges have received repairs. There has been $2,280 spent for the improvement and care of parks. The repairing and improvement of streets has cost $53,595. The entire expenditure of the department has been $71,849, and the unexpended balance is $413.

The superintendent of sewers reports that most work has been done in the development of existing mains. Extensions and connections have been made on Adams, Park, Court, Hillman, Bridge, Lyman, Chestnut, and Pine streets. The work of cleansing lessens each year. He reccommends that the city adopt regulations for house plumbing like those in force in New York and some other cities; also the extension of the Worthington street sewer to Lake Como, the improvement of the river front between Bridge and York streets by a small main through Wilcox and Water streets. The expenditures were $33,588, against $35,020 in 1882.

Hopkinsville, Past, Present and Prospective.

DONE IN WATER COLORS.

THE HYDRANT.

When fire-fiends with blazing brands go prowling round the villages,
When tramps with benzine armed seek out the towns where fattest pillage is,
When gasoline and coal-oil casks explode like battle cartridges,
When mules in burning stables are broiled alive like partridges,
When fire-alarms with panic rout the Sunday morn conventicle,
When church and fire-bells ring their peals in key and pitch identical,
When Jerseys, lowing in their stalls, like snipes on toast are frying up,
When skyward flaming wisps of hay, like serpents winged, are flying up—
Such holocausts, O Mexico, were thine when Cortez time was in,
When thou was grilled alive on coals, O, fricassed ¶Guatimozin!—
When shouts of "Fire!" from trampling crowds stentorian and clamorous
Cut short the street gate colloquy moonlight moments amorous,
When blocks are baked like Dresden plaques within a glowing pottery,
And grinning demons make us wince beneath their impish cautery,
Don't damn *the fire*, dear public, don't, in imbecile profanity
Dam Little River, dam it well, and vindicate your sanity.
Don't say "We've ponds, pumps, cisterns' squirts—the weather's often showery:"
Play hydrants on the raging flames, and say good luck! to Loweree.
Nothing puts out a fire so quick as water, and no scant of it,
Nothing *puts out* a fireman, on duty, like *the want of it;*
'Tis enough to stir with anger your cemetery's *pious* dust
To see a toiling fireman doomed to pump a cistern dry as dust.

"Three thousand dollars! "Croaker says," 'Twould build us a distillery!
Now if hydrants spouted cocktails, French brandy, beer or §Sillery—
But this water-on-the-brain is positive insanity.
For 'twas Noah's *Water-loo* which swept the earth of its humanity."

Flow hydrants flow! to teach the town municipal hydropathy.
Flow hydrants flow! Our streets reject aquatic homœopathy.
Through every sewer now shall run the cleansing waves abundantly
And send through all the avenues the copious stream redundantly;
The urchins in the gutters wade, or like Colossi straddle 'em
And infant sailors launch their boats and down the waters paddle 'em
Or youthful merchant millers with mechanical precocity
Exult to see their paddles whirl with musical velocity
Or in the mimic sea-fight urge the stronger or the *weaker* ship,
Or bob with pins as Randall bobbed when fishing for the Speakership.

In every household now prevails a boisterous felicity,
Housekeepers all are mad with joy, like frogs with electricity;
The mother crys to every one: "See how my darling daughter works,
She washes, rinses, sprinkles, scrubs, all on account of water-works;
To every passer-by she shows her *hose* without apology,
And talks of hydrostatics, and hydraulics and hydrology;
How's that for high? My husband, wretch! a jeering Mephistophles
Declares the girl's affected with a chronic hydrocephalus,
And swears if she was not so young—the tender child may *thank* her age!
He'd send a note to Doctor Clarke to duck her well at Anchorage!
And so from morn till night the talk is "Water! water! everywhere,"
Like the illimitable sea around the Ancient Mariner."

Flow, hydrants flow! and drive with speed the ponderous machinery,
Or douse the thievish vagabond, or clothe the yard with greenery
Or in solemn fane where flow the waters apostolical
Fill up the baptistry or the marble font symbolical;
Or from the fountain rear aloft the crystal shaft aquatical
And round it in the sunshine twine moist wreaths of spray prismatical,
Or lay the dust in avenues where whirl the gay *en-bri*olets,
Laden with "rare and radiant" girls, the Hopkinsville sweet violet;
Blest water! in a thousand forms it strews its gifts incessantly,
Sometimes, a brook, it winds its way through meadows green quiescently,
Sometimes by night, o'er tropic seas it flashes phosphorecently,
Sometimes in heavenly arch it sets its jewels iridescently,
Down Echo River loudly sings in subterranean cavity,
Or like a god in wrath roars down Niagara's declivity.
Flow hydrants, flow! with verdure crowned returns old friend St. Nicholas
With mistletoe and cedar bough and holly branch to tickle us,
Perennial boy! though centuries old yet still he loves the best of all.

NOTES BY PRINTER'S DEVIL.

¶ Talking of quail on toast, Prince Guatemozin didn't *quail* on the dev'lish *toast* which the Spaniards made for him. He was probably called *Gua*-temozin because he didn't have a *gay* time, and would have doubtless paid $3,000 per annum for the use of sixty hydrants to play upon his "*bed of flaming roses.*" These are bad puns, but Guatemozin himself was badly *pun*-ished.

* Dan'el Webster and old Worcester-sauce don't pronounce the word this way—but so much the worse for the dictionaries.

§ "I'll charge and command that of the city's cost the conduit run nothing but claret wine.—JACK CADE, *King Henry VI.*

To drive his team when skaters cleave the crowd at Christmas festival:
Tom Buckner! all the world's a Rink, and Fortune's wheel is rotary,
And everybody skates his course in his respective coterie;
Just turn the gushing hydrant on the Skating Rink and freeze it up,
And multitudes on gala days will seek the hall and squeeze it up.
A roller loose or buckle slipped no more shall trip the the silly cuss,
And make him "get upon his ear," or bruise his poor *umbilicuss.*
But rival skaters shall contend for pretty silver chalices
And carve their names in solid ice where Buckner's Arctic palace is.
O, Tom, your Skating Rink is nice, but start a natatorium.
Make Hopkinsville a Weiss-Baden and sanative emporium.
With Turkish baths for nervous folks, and Russian for sciatical,
And vapor baths to ease the gout and purge off ills hepatical:
Go "pool your issues;" let the boys go frolicking like porpoises,
And float and dive and tread the waves and polish off their *corpus-es.*
Some Public School boys need the bath, and if you only had 'em we
Both bonds and scents might *liquidate* of our own beloved academy.

Flow hydrants, flow! we'll celebrate this aqueous anniversary
With turkey in the dining-room and taffy in the nursery.
We'll fry the jolly frog-legs and pepper 'em and salt 'em o'er,
With celery and oysters and canvas-backs from Baltimore,
(These give her maids their peach cheeks—what diet could exalt 'em more?)
And the parson's mouth shall water while he invokes a benision,
O'er the dish of well browned hominy and haunch of juicy venison;
And then puffing our Havanas on the divon, lounge or otoman,
We'll tell the tale of Undine, the water-nymph who caught her man,
Till our eyes shall turn to hydrants running o'er with tears of jolity,
For the wisest relish nonsense in brief seasons of frivolity.

Flow hydrants, flow! a bumper now we'll drink to old Aquarius,
Flow hydrants, flow! to health and wealth his living streams will carry us.
The toper on the hydrant leans, and of its freshness emulous
With fevered brow and bloodshot eyes he lifts his hand so tremulous,
Looks back upon the years when once his pure unsullied *youth* he ran,
And thus exclaims: "O Governor Knott, thou† solemn-faced † Dulutheran
Marine of 'unsettled seas!' behold one whose œsophagus
Could drain the tun of Heidleburg and be his own sarcophagus,
These bleary eyes and shaky hands proclaim my head a sappy one,
Behold my purple Bardolph nose! My lot is not a happy one!
And my grocer and my butcher and my milk-man, all malevolent,
Whisper '*Ausgespielt!*' and 'Ichabod!' and other terms equivalent.
Pardon Tom Henry and '*Me too!*'—God knows we all get tight enough,
Poor human nature's weak and frail—our hearts I think are right enough,
Tom's *Gaines* are *Poore*, and so are mine—I prithee, Proctor, pardon us!
Don't coldly turn away, I beg—a freezing look might harden us;
Make me a Colonel of the Staff—a *Fal*-staff I would scorn to be—
Or Corporal of the Loweree Guards—a warrior I was born to be—
I'll hug no more the lamp post, a feeble-kneed *saloon*-atic,
Henceforth the hydrant for my friend morning and night and *noon* I take,
Forswear all strong potations, drink water—for variety—
And become a biped hydrant of Hopkinsville society."
—*Carrier's Address to the Patrons of the Ky. New Era.*

† A Lutheran is a follower of Martin Luther, and a *Dulutheran* is *Knott* Lutheran—a superior or Lake Superior kind of Lutheran.

A NEW COMPASS.—M. Mascart, the well-known electrician, has devised a new compass which finds the magnetic meridian by the well-known experiment of moving a coil of wire across the lines of magnetic force of the earth and inducing a current in them. M. Mascart employs an azimuth circle on which is mounted a ring movable round a horizontal axis. The angle made by the ring with the horizon is measured by a vertical circle. A coil of 0.12 metres in diameter is carried by the ring and can turn round an axis perpendicular to that of the ring. The size of the apparatus is not greater than an inclination compass. It acts on the principle that when the axis of rotation of the coil is in the magnetic meridian the induced currents in the ring when rotated will be nil. A sensitive galvanoscope is employed to show the induction currents. In using the apparatus, a series of trials show that the axis of the ring is perpendicular to the magnetic meridian. A second series place the axis of rotation of the coil in the line of the inclination needle. The observation, with checks, occupies half an hour, which is less time than is necessary to find the inclination by a magnetic needle. From observations made at the Observatory of the Parc Saint Maur, by M. Mourceaux, the new compass seems to be as correct as the inclination compass.—*Engineering.*

THE DARK SIDE OF PARIS.

Paris Correspondence New York Times.

In 1789 Paris contained 650,000 inhabitants, and there was only one other city in France that had more than 150,000; this city was Lyons. In 1882 Paris contained 2,225,910 inhabitants and Lyons over 300,000. Speaking about the territory and the population, M. Fournier de Flaix says that it took 15 centuries to increase the population of Paris from 8000 under Julian, toward the end of the fourth century, to 1,000,000 in 1840. In Julian's time its extent of territory was only 97 acres; at the beginning of the 13th century it had 632 acres; it was doubled under Henri IV, and had a population of 200,000; under Louis XIV, the territory was again doubled and the population numbered 550,000. Thus, during the 17th century the perimeter and the population doubled twice. Louis XVI tripled the perimeter in 1788, but the population remained almost stationary. From 1788 to 1860 the size of the city did not legally change, but in the latter year, all the territory within the fortifications, 19,505 acres, became the legal perimeter. The force of the current of city agglomeration is shown by this movement of the population. It took 19 centuries to accumulate the first million, and in 30 years this million has more than doubled. There is nothing new in this collection of great cities like London, Paris, Pekin, New York, etc., but what is new is the number of cities having more than 500,000 inhabitants spread over France, England, Germany, Italy and the United States; this, says M Fournier de Flaix, is the characteristic fact of contemporary civilization. The result of the rapid increase of the Paris population is that the city is becoming dangerously overcrowded in certain quarters. Each inhabitant has now about 34 meters space while in London he has 79. Taking out the five Parisian parks, which measure 4750 acres, each inhabitant really has only 26 square meters, which is about the same space he had under Louis XIV. The parks increase the salubrity of Paris to a certain extent, but they also restrict the number of houses and the size of the quarters where they are laid out. The opening of new streets has also reduced the amount of building space; and the number of houses erected during the past 50 years has been in greater proportion than the increase of the population; but the number of lodgings has not followed the same progression. The result is that to-day the average number of individuals in each house is 30. This average does not give an exact idea of the situation, either, for some of the quarters are overcrowded to such a degree that certain parts of the subsoil of Paris are profoundly vitiated. There are 191,500 apartments for the rich people and those in easy circumstances, forming a population of 500,000, and 472,000 apartments for 1,500,000 persons, which gives 2.60 in each apartment for the one, and 3.10 for the other. Besides these, there are 200,000 individuals who cram themselves into 11,753 furnished lodgings. Another proof of the overcrowding is the price of land. In the extreme quarters there is little to be had below $10 a meter, and the average price of the hectare (about 2½ acres) is as high as $400,000. Another result of this crowding is that the mortality is 25.50 per 1000, while in London, which is nearly double the size of Paris, and where each inhabitant has 79 meters of space, it is only 23. The conclusion which M Fournier de Flaix draws from these statistics is that it is necessary to enlarge Paris; for, while there is still unoccupied land within the fortifications, he thinks that a greater number of houses would render the city still more unhealthy.

The circulation in Paris is enormous. It is estimated that 800,000 persons move about each day in some kind of a conveyance. The result of all this movement is dangerous crowding, accidents, and loss of time. Paris is behind all the other great cities in rapid transit. This comes from various causes; changes of government and administration, the influence of artistic ideas and prejudices, etc., but more especially, our economist thinks, from an error shared to a certain extent by the population itself. "This error consists in admitting that Paris is rather a city of pleasure than a city of work, and consequently is doing a great deal for the former and not enough for the latter. This error is a very old one at Paris, and is so profoundly rooted that it was turned to account for political motives under the empire with a baleful persistency. The excuse was to attract the foreigners to Paris. Even the other day the Director of Public Works, who has occupied the position for the past thirty years, found no other argument to defend before the City Council a loan designed in great part for the sewers than this: "The rich Americans have got into the habit of coming to Paris to spend their fortunes; consequently we must beautify the city." Paris is, above all, says M. Fournier de Flaix, a city of work, it is the

greatest industrial center of the world, as London is the greatest commercial and maritime center. The real Parisian, the workman, he says, compensates for most of his faults by the love and efficacy of his work. The statistics show that these workingmen are more than four times as numerous as the pampered class. Perhaps from among these industrious citizens will come the "sound remnant" which the distinguished Englishman has lately told you is needed to save this country. The preponderance of working people here is shown by the nature of the apartments and the rents paid. There are only 5500 apartments which rent for more than $1200; the number which bring from $200 to $1200 is only 56,000; from $60 to $200, 130,000, while 472,000 rent for less than $60. The industrial character of the population is also indicated by the number of buildings let for trade and manufacture. All these facts show that Paris is not, as is so often supposed, a city entirely given over to pleasure; but the error is a natural one when it is seen how much is done for the embellishment of the city, and how little for its real needs.

While the salubrity of the city has certainly increased during the last 40 years, there is much still to be done. Since 1869 the mortality has increased a fifth, and most of the increase is due to endemic maladies. The hospitals have been insufficient to receive the sick, and the cemeteries the dead. Typhoid fever prevails to a great extent, and one of its causes is the insufficiency of water. Out of every 100 cubic meters of the supply 75 are used for watering the streets and only 25 for house purposes. While the city itself is brilliant and clean the air is not so pure as it should be, the human miasma formed in the houses, barracks, workshops, etc., vitiate it rapidly. The sewers are not only inadequate, but the annual increase of poisoned water poured out of them into the Seine and the Marne will soon make Paris and its suburbs a pestilential sink. The insufficiency of the hygienic regime is increasing the misery as well as the mortality.

Most Americans who have visited London have been struck with the amount of misery in the streets, and have remarked its absence here. Unfortunately it exists, although kept out of sight as much as possible by the admirable and numerous charity organizations. Mortality and misery are the two daughters of malady, and it is still more by sickness than by vice that misery penetrates into the workingman's family, and gnaws it. In 1877 the official total of the poor of Paris was 113,317; in 1880 it was 123,735. Twice since 1860, following good harvests, in 1869 and 1874, a diminution of the misery has been noticed, but it increased in 1877 and 1880. To the official misery must be added the secret indigence; under this head 104,236 persons were assisted in 1881. The statements of the public assistance society do not agree with the census returns; they acknowledge 140,000 poor in 52,160 households. Poverty, like sickness, shows itself in all the quarters; it is increasing in the richest part of the city. From 1860 to 1878, the number of objects pawned at the public pawnshops rose from 38,000,000 to 50,000,000, and to 53,000,000 in 1881. At London, on the contrary, the misery is decreasing. In 1871 the number of in and outdoor poor was 153,293 for a population of 3,113,000; in 1881 it fell to 99,039 in a population of 3,815,000 inhabitants. This comparison is distressing, says M. Fournier de Flaix, but it is interesting because it demonstrates that it is not so much in the fact of the enlargement of a vast human agglomeration as in the defectiveness of the hygienic conditions. Another cause of the misery at Paris is the exaggeration of the octroi tax; but sickness is the principal one. These two causes can be successfully combated; it depends entirely upon the city administration. From 1877 to 1881, there were 284,625 births and 260,887 deaths. In 1880 the deaths exceeded the births. The average number of deaths yearly is 50,000, but in 1881 there were 57,000. All these facts show, says M. Fournier de Flaix, that the mortality, the misery, and the sickness of Paris come from overcrowding, for the topographical situation of the city is as healthy as it is admirable.

One of the direct causes of the increase of large cities is the ease with which they can be provisioned by railways. There is, however, a difference at Paris, which alone levies a tax on all food and drink coming within the fortifications. This octrai tax adds more than $16,000,000 to the cost of provisions brought into the city, not including the spirits. This levy represents a contribution of $26.60 per household. Without this tax, the conditions of provisioning Paris would be excellent. The quantity of food consumed annually gives, on an average per head, 347 pounds of bread, 176 pounds of meat, and 200 liters of wine. The price of wine has increased, but the average price of bread has slightly declined during the past ten years; the price of each kind of meat except mutton, has diminished. The resources of Paris in butter, cheese, vegetables and fruits are inexhaustible. The Spanish gardeners send their oranges and their asparagus; the market-gardeners of Italy and Algeria all sorts of primeurs. Fish and oysters have never been so cheap, but they are still, especially oysters, much dearer than at New York. There is another side, however, to this flattering picture—wine, milk, coffee, butter, flour, in short, everything eatable, is adulterated, and this adulteration increases with the population. Municipal laboratories have been established to keep these frauds down as much as possible, and they render good service; but the wine dealers, who are so powerful in numbers here, are trying to have the analysis of wine abolished, and they have found some of the Paris deputies who fear the loss of their votes, to make promises for its suppression. In 1881, upon 3,361 samples of wine examined, fifty-six per cent. were found bad, and six per cent. dangerous.

TOWAGE BY ENDLESS CHAINS.

An interesting experiment in the towage of vessels by means of endless chains has been made on the Rhone by M. Dupuy de Lome. That river is troubled with rapid currents and stony shallows, hence navigation is troublesome on it, and it has not, therefore, been utilized to its utmost. The state of the bed is improving every day, however, owing to the dredging and other engineering operations now carried out; but after these are executed the Rhone will still remain too swift at several parts for ordinary sailing. Towage by means of ordinary chains is also open to several objections which do not hold in the case of towage by means of endless chains worked in the following manner: A tug-boat is provided fore and aft on each side with an endless chain, sufficiently heavy, and plunging into the water so as to rest on the bottom for a space, the part on board being sustained by pulleys. These pullyes being turned by hand or by an engine, the chain moves with them propelling the boat against the stream. The chain on each side is actuated by a separate motor, the craft is steered by making one chain move faster or slower than the other. The chains are disposed in such a manner that for the greatest depths, the weights resting on the bottom produce an adhesion to the latter still greater than the drag of the tug and its convoy. The experiment of M. Dupuy de Lome was made at the instance of the Minister of Marine, M. Zédé, director of naval constructions in France, and took place at the Port-de-Bouc. The tug was a vessel 33 metres long by 7.50 metres wide, and 2.10 metres deep. The two strong chains employed weighed 46 kilogrammes per running metre. Each was worked by an engine of 15 horse-power, and the two machines were completely independent, but the valves and starting gear were under the control of one man. The trials showed that the barge could be properly steered and propelled in this manner in varying depths. The proper length of chain for the depth was regulated by increasing or diminishing the distance between the front and rear pulleys. The depth varied from 1 to 6½ metres, and provision was made accordingly. The coefficient of friction of the chain on the bottom was found to vary with the nature of the bottom from 80 to 120 per cent. of the weight of the chain in the air. It was thus possible to calculate what the current should be in order that the chains should not slip on the bottom. Currents of 3 metres per second were successfully encountered and overcome, and the vessel could be properly manipulated in these rapids with a safety unknown to other methods of navigation. The new plan of M. Dupuy de Lome is in fact highly interesting and ingenious, and may be useful in mounting rapid rivers in many other countries.—*Engineering.*

A shrewd and very questionable trick has been defeated by Secretary Folger in awarding the two years' contract for carting dutiable merchandise to the appraisers' stores in New York City to the New York Transfer Company. Among the bids submitted in August was a remarkably low one purporting to come from John R. Wood of New York. He was given the contract, and then it came out that he was a jeweler and knew nothing about the bid. Instead of declaring a new deal, throwing out the other bids and exposing the figures, as the sender of the bogus bid evidently expected, the Secretary made the award to the next lowest bidder.

SELECTED MISCELLANY.

According to *L'Electricite*, the doubling of the Paris telephone wires—the only ones as yet laid underground in the French capital—is very nearly finished

LEATHER wheels are made in France for railroad and other cars. The inventor of the process is M. de la Roche. Untanned buffalo hides are cut into strips, and these are built up into solid discs, which are strongly held together by two iron rings after they have been subjected to hydraulic pressure.

IN the stores of Paris glass is taking the place of wood for flooring. It costs more than wood but it lasts longer, and besides being easily kept clean allows enough light to be transmitted through its roughened surface for the employès to work by in the floor beneath. The glass is cast in squares and set in strong iron frames.

THE railroad from Liege to Maestricht, says a Belgian paper, has obtained permission to put upon its track between Liege and Vise, small trains made up of cars of the ordinary horse-car pattern. These trains stop between stations, and they are found to be a great convenience for the small villages along the route. The object of the company in inaugurating this system of conveyance was to prevent the establishment of a competing street-car line.

MR. JAMES STEVENSON, of the Geological Survey, has reported to Major Powell, as one of the results of his field operations, the discovery of several more ruined cave and cliff cities, differing in some respects from any he had before examined. The most remarkable was a village of 65 underground dwellings situated near the summit of one of the volcanic foothills of the San Francisco Mountains in the San Juan region of Arizona. The surface stratum of the hill had become hardened and formed the common roof for the entire community.

THE trusses of the old part of the roof of the Basilica of St. Paul, in Rome, a contemporary remarks, were framed so far back as the year 816, and were found to be perfectly sound and good in 1814, after the lapse of nearly a thousand years. These trusses are made of fir. The timber-work of the external domes of the Church of St. Mark, in Venice, is more than 810 years old, and it is still in a good state of preservation. Timber under favorable circumstances lasts very long. Sound logs, for instance, are dug out of bogs from time to time from places where they have lain for an indefinite period.

M. YVON VILLARCEAU, a distinguished member of the Academy of Sciences, has just died in Paris, where he was well known as a civil engineer. An amusing anecdote is told of him in connection with Félicien David. He had joined the Saint Simonians, and after that society was dissolved he went to the East in company with the eminent composer, who took his piano with him. While staying at Smyrna, the tourist's money ran short. What to do was the question. A brilliant idea struck Félicien David. He placed his instrument on a truck, and Villarceau drew it about the streets. The musician played the piano, and a perfect harvest of paras was everywhere reaped. "We were not in the least ashamed," Villarceau used to say, "for was not Smyrna the land of Homer, where the divine blind bard begged before our time with his lyre in his hand.

Experiments have given the following facts regarding illuminants. The heat produced is in this ratio: arc electric lamp, 57 to 158; the incandescent electric lamp, 290 to 536; the argand gas-burner, 4,860; the colza-oil lamp, 6,800; the flat-flow petroleum lamp, 7,200; the paraffine candle, 9,300, and the tallow candle, 9,700. Water-producing properties give these figures: Electric lamps, practically none; argand gas, .86; colza-oil, .65; flat-flow petroleum, .80; paraffine candle, .99, and tallow candle, 1.05. The amount of carbonic acid generated is thus represented: Electric lights, none; argand gas-burner, .46; flat-flame petroleum, .95; colza-oil light, 1; paraffine candle, 1.22, and tallow candle, 1.45. It has been remarked that the tallow candle, the oldest of these artificial lights, is not only the hottest but the most unhealthy.

The Arabian, an engine belonging to the Baltimore & Ohio Railroad Company, which has gained considerable celebrity during the past few years, having been exhibited at expositions in various parts of the country, and which was greatly damaged when the Pittsburg Exposition Building was burned, a few months ago, has been rebuilt at the Mount Clare shops in Baltimore, and in a few days will be again placed in service as a shifting engine in the yard. The Arabian has something of a history. It was built at Mount Clare in 1834, and was one of twelve machines under the superintendence of Mr. Eneas Davis, the designer, who was afterward killed by it. For a considerable time the Arabian was used to haul passenger trains between Baltimore and Harper's Ferry, and it frequently attained a speed of fifteen miles an hour, a high rate of speed for that period. After a while, however, the demands of modern railway travel compelled the Arabian and others of its class to give place to more powerful engines, and for thirty years past it has not been in operation outside of Mount Clare yards, except when sent to other cities to be placed on exhibition.

Engineering News

AND

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ENGINEERING NEWS.

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PROF. LEWIS M. HAUPT'S new book "The Topographer," noticed at length in our advertising columns, is out of the printer's hands. We will fill the orders now on hand in this office as fast as the books can be shipped.

THE January number of the *Journal of Progress and Wood-Workers' Magazine* deserves more than a passing notice. In contents, illustration, taste in make-up, and excellence of paper and press-work, it will serve as a most worthy model. We wish success to our Philadelphia contemporary, for it is certainly deserving of the same.

THE Journal of the Association of Engineering Societies, for June, 1883, has appeared. It contains papers, etc., as follows: "Time Signals," by George W. Blodgett, of the Boston Soc. C. E.; "Defects in Structural Castings," by Thomas D. West of the Civil Engs. Club of Cleveland; "Francis Ulric Farquhar," a memoir by Gen. O. M. Poe, of the Western Soc. C. E.; "The Destruction of an Iron Bridge on the Illinois & St. Louis R. R., at Hillsboro, Ill., by an Electric Cyclone," by H. M. Claflin, Member of the Civil Engs. Club of Cleveland; "Magnetic Geology, or What I know about the Divining Rod," by Charles Latimer, of the Cleveland Club.

PROF. ELLIOTT, of the Smithsonian Institute, says the Alaska Indians are making salmon nets of the 900 miles of wire laid by the Overland Telegraph Company, many years ago, at a cost of about $3,000,000. It was believed at that time that the Atlantic cable would be a failure, and this line was started for Europe by the way of Behring's Straights and St. Petersburg.

STATE Engineer Seymour has brought a hornet's nest about his ears by his unfavorable report on the Erie canal and by his very evident opposition to the improvement or continuance of the same. The press and the business men of the community seem to unite in denouncing his report as unfair and as written in the interest of railroads.

He is also apposed to the state preservation of the Adirondack forests, and yet in the same breath recommends the construction of storage reservoirs in that region as feeders to his canal. One of the chief arguments advanced in favor of the purchase or keeping intact this great wooded district of the State of New York is the preservation of the sources of the Hudson and some of its upper tributaries, in the interest of a general water supply, not only for the canal but for the many wants of the people.

THE broken fortunes and broken health of Henry Villard add a sad chapter to the already eventful history of the road of which he was so lately the master spirit.

In a few years he had raised himself by his extraordinary energy and executive ability, from the position of a hard-working newspaper correspondent to that of the most conspicuous figure in the railroad world of his adopted country. His faculty for commanding the confidence of capitalists was unequalled, and it is pleasant to note, in the light of the present evidence, that he did not betray this confidence. He struggled manfully against the machinations of his enemies and the financial depression of the past year, but when wreck was inevitable he stood to his post and, as far as his own interests were concerned, went down with his ship.

He may have made mistakes and blundered in his estimate of men and the times, but if all current reports be true, he has sacrificed his entire fortune in the interests of his late roads. He cannot thus be classed among the "wreckers" who ruin the many that a few may profit.

THE RAMAPO IMPROVEMENT CO.

The *Times* of Jan. 9, says that F. A. Conkling President of the Ramapo Improvement Co. submitted, on Jan. 8. to the Commissioners of the Sinking Fund, a proposal to construct an aqueduct from the Ramapo water shed in Rockland and Orange Co's. N. J., to deliver 50,000,000 gallons of water daily at the northern line of the city, and at an elevation of 300 feet above mean tide level.

The above company is to assume all cost of construction, the City of New York will not be called upon either to issue or guarantee bonds for the work, the only condition being that it agrees to pay for the water delivered at the same price per million gallons as the cost of the same quantity of Croton water in 1882. The company undertakes to complete the aqueduct within two years from the signing of the contract.

The officers of the company claim that their surveys establish the fact that 808,000,000 gallons daily can be drawn from the Ramapo and adjacent water sheds; that this water can be delivered anywhere in the city at the tops of the highest buildings with a sufficient head remaining to throw a stream equal in volume and power to the best fire engine in service. They offer to submit their plans and surveys to the commission for the consideration of experts.

DENVER, Colorado is progressing; last week a petition was presented to the councils of that city from the Denver Elevated Railroad Co. asking for a franchise, to build a road.

The census of 1880 gave Denver less than 36,000 inhabitants, it now claims 70,000; a pretty fair advance for the three years, and the citizens seem to think they are entitled to all the modern improvements.

THE Phila. *Press* is finding fault with the leisurely methods adopted by the water department of that city in the investigation of the causes leading to the contamination of the Schuylkill water. Fifteen months ago this water was pronounced by physicians unfit to drink, and an inspection has only now commenced at Pottsville; after the investigators have reached the city and made their report to the Chief Engineer, it is expected that councils will adopt some method of abating this great nuisance.

THE Boston *Journal* very properly finds fault with the outgoing Common Council for 1883, of that city, for signalizing its last meeting by passing an order, in concurrence with the Board of Aldermen, appropriating $250,000 for recording meters and waste-water detectors.

The *Journal* thinks this action hasty, suspicious and uncalled for in the light of the fact that only one-fourth of the meters constracted for under the late appropriation of $80,000, are now in place.

It seems that $150,000 of this new sum voted is to be expended in the purchase of the Tremont water metre, of dubious origin; a metre to which we have previously referred, and one never yet sufficiently tested to warrant this vastly increased expenditure.

The hasty action noted strongly suggests that certain private interests, of a kind not unknown to the "city fathers" of the present day, may be more benefitted by this appropriation than the taxpaying public.

The Institution of Civil Engineers.

The latest publications of the Institution received are the following: Annual Report of the Council; Electrical Units of Measurements, by Sir Wm. Thomson, F. R. S.; The Northern Pacific Railroad, by George Barclay Bruce, Vice Prest. Inst. C. E.

The more important contents of the annual report are given in a record of the annual meeting of Dec. 18, in another column, and the paper of Vice Prest. Bruce has already been briefly noticed in our issue of Dec. 8.

Brooklyn's Water Supply and Sewerage.

Mayor Low, of Brooklyn, N. Y., in his annual message, recommends an immediate enlargement of the distributing reservoir at Ridgewood to double its present size. He says there is literally no reserve supply over the city's need, and thinks an increase of 20,000,000 gallons daily necessary; and that any new plan should keep in view an ultimate daily supply of at least 100,000,000 gallons. The cost of this work is estimated at about $4,500,000.

The Mayor also says it will require from $1,500,000 to $2,000,000 to remedy existing defects in the sewerage system of the city.

Size and Terminus of the New Aqueduct.

THE Aqueduct Commissioners concluded the public hearing on the size and terminus of the proposed Croton Aqueduct, last week. The arguments heard have been almost wholly in favor of a large aqueduct, 18 ft. or more internal diameter, and the Croton Dam as a starting point. Boiled down, this evidence means that with a sufficiently large conduit and proper management of the storage reservoirs already built, the building of the gigantic dam at Quaker Bridge is not just now advisable, and may never become advisable. As frequently

mentioned, inadequate size in the present aqueduct has occasioned more trouble in the past than any want of water in the Croton storage dams; and while the larger supply of water will not remedy the lack of head in the lower portions of the city, the 35 ft. of additional head gained by the construction of a new dam at Quaker Bridge would be of little avail in correcting this evil.

Robert L. Darragh, formerly a Commissioner of the Croton Aqueduct Department, strongly advocated before the present commission a conduit not less than 18 ft. diameter; and in opposing the Quaker Bridge Dam, gives the following table as showing the storage which would be made available by the large aqueduct and plan proposed:

	Gallons.
Storage which we now have in this city, and which would be made available by having an aqueduct large enough to fill it at such times as a heavy draft was upon it	675,000,000
Storage gained in a large aqueduct	237,500,000
Gained by connecting the large aqueduct at a lower grade with the dam	1,500,000,000
Additional supply from the Bronx River works, which are now nearly completed	3,650,000,000
Additional storage by constructing a new reservoir north of the Harlam River	1,029,880,145
Total	7,092,380,145

Storage room to be acquired by building dams in the upper part of the Croton Valley, as laid down on map of the Croton Aqueduct Department in 1857 and 1858, in addition to that we now have:

Reservoir.	*Gallons.*	*Reservoir.*	*Gallons.*
A	5,211,015,625	J	2,314,074,703
B	1,701,835,337	K	5,671,449,249
C	6,589,101,562	L	2,328,217,733
D	9,033,632,812	M	4,392,131,445
F	6,120,335,937	N	1,676,049,171
H	2,490,062,500	O	2,182,337,109
I	4,205,820,654		
Total	53,916,063,807		

I have not estimated the rainfall or filteration in either the impounding reservoirs or the Quaker Bridge Dam. assume that the filteration in the Quaker Bridge Dam would be the greater, owing to the water pressure being very much heavier.

Brooklyn's Interest in the East River Bridge.

Mayor Low in his message gives the following facts and figures relating to the interest of Brooklyn in the East River Bridge. He says that the total amount of outstanding bonds issued by Brooklyn on account of the bridge, is $12,245,237.37; the amount of interest paid up to 1884, without compounding, is $2,462,852.30. Up to Jan. 1, 1884, the earnings on the bridge were $175,970.33; expenditures for maintenance $148,753.47, showing a net earning of only $27,216.86. The earnings of the bridge for the last two months have been at the rate of $37,000, or $444,000 per annum: to pay Brooklyn $150,000, which the law requires that city to pay into the sinking fund each year as against the bridge bonds, would involve a payment of $75,000 to New York, and leave for running expenses, $219,000.

Engineer's Club of Philadelphia.

RECORD OF REGULAR MEETING, DECEMBER 15, 1883.

President Henry G. Morris in the chair; twenty-two members and one visitor present.

Mr. E. F. Loiseau presented a description of a new press for the manufacture of paving blocks from asphalt and crushed rock; and the application of artificial fuel press to the manufacture of hydraulic cement. Specimens were exhibited.

Mr. Washington Jones presented an illustrated description of a single seat, balance steam and water relief puppet valve.

Mr. Wilfred Lewis presented notes on clamping bolts.

Three large framed photographic views of Fairmount bridge, Philadelphia, were received as a contribution to the library, from Mr. A. B. Leuffer.

The sixth annual meeting of the club will be held this evening, (January 12, 1884), at eight o'clock.

The annual address, by Mr. Henry G. Morris, retiring president, will be delivered; the reports of officers for 1883 will be submitted; the ballots for officers to serve during 1884 will be counted by the tellers, and the result thereof announced; and the officers for 1884 will be installed.

NEW PUBLICATIONS.

"*Tables for computing Equivalent Metric and Non-Metric Weights and Measures,*" by W. A. G. Emonts, C. E., Phila. 1883.

The title reads well, but unfortunately the tables given are not sufficiently extended and they are unaccompanied by any text giving the engineer data for extending them for himself; nor is the arrangement at all satisfactory. In this latter respect the printer is perhaps as much to blame as the author.

We have received the Annual Report upon the improvement of harbors of Lake Erie, west of Ashtabula, and the improvement of Sandusky River, Ohio; these works being in charge of Maj. L. Cooper Overman, Corps of Engineers U. S. A. These reports are for the fiscal year ending June 30th, 1883.

The work done during the year on Lake Erie includes the improvement of Monroe Harbor, Mich., at a cost of $1,016.45; Toledo Harbor, Ohio, cost $29,849.99; Port Clinton Harbor, Ohio, cost $5,995.17; Sandusky City Harbor, Ohio, cost $7,824.93; Sandusky River, Ohio, $3,392.31; Huron Harbor, Ohio, cost $4,685.95; Vermillion Harbor, Ohio, cost $492.34; Mouth of Black River, Ohio, cost $821.87; Rocky River Pier, Ohio, cost $1.06; Cleveland Harbor, Ohio, cost $137,537.36; Fairport Harbor, Ohio, cost $1,772.24.

Treatise on the Use of French Rock Asphalt (Seyssell) with Translation of a Paper Read before the Society of Civil Engineers, Paris, by M. Leon Malo; published by E. H. Wootton, 1884.

We have several times lately, referred in our columns to the paper of M. Malo, which is here given in full, and can recommend it as most interesting and profitable reading to all interested in the composition, manufacture and use of asphalt. One of the chief points made by the author is that, even in France, not one engineer in five, knows what asphalt is. It is erroneously looked upon as a soft material, easily affected by heat, and as being very inflammable. M. Malo proves that when used in masses sufficiently thick it is as firm as cement, and Prof. Atfield, F. R. S., testifies that he has analyzed and tested it with the following result: that it contains a small portion of bitumen, which, if extracted would burn, but about ninety per cent. of all asphalt was earthy matter which would put out flame better than water.

These are points already recognized by some of our best architects in their adoption of this Seyssell Rock Asphalt as a fire-proof roof covering.

Regarding its application to masonry, M. Malo shows that its use was as old as the Tower of Babel, "where they had brick for stone and—*bitumen procemento*"—according to the Latin version, though our English translation makes "slime" in some unaccountable way out of the earlier Latin "bitumen."

TRADE PUBLICATIONS.

The Pencoyd Iron Works of Philadelphia, A. & P. Roberts & Co., have lately issued a book of "Shapes," manufactured by them, that in size and perfection of workmanship exceeds anything of that class of publications ever brought to our notice. The book is 15"x20", showing in full size beams and channels up to 15 in, in height. The dimensions are given with all the shapes illustrated in the fullest manner.

THE SURVEYOR IN 1671.

In William Lilly's Astrological Ephemeris, published at London in 1671, is given the following advertisement, which show that, even in those ancient days, surveying and engineering were closely connected:

James Ward, of Langley in the county of Buckingham, Mathematician and Surveyor, having performed several water works with good applause near unto the place where he lives, and elsewhere; is willing to undertake, and doubts not of his performance, of conveying water, either by cutting new rivers, or by channels unto any place whatsoever, where it is possible to be done; he also undertakes the new building or repairing of bridges over rivers, as also the reparation or new building of water mills, or any water works, as also the hanging of bells, or any other architectures, dyalling, or surveying of lands, guaging of vessels, ets.

KERITE TELEGRAPH CABLE.

Kerite is the invention of an American manufacturer, Mr. A. G. Day, who was impelled by the increasing cost of india-rubber to seek a substitute for it as an insulating material for electric wires. The invention is patented, and the substances of which kerite is composed are not made public; but it is known that it is composed of various bodies. It may be combined with india-rubber, sulphur, and oxides of metals in the usual manner renders the india rubber more durable, while reducing the cost, and is applicable to the whole class of goods into the manufacture of which caoutchouc enters. At Mr. Day's factory at Seymour, Conn., the whole process of the manufacture of cable is carried on, except that of making the wire. The ingredients of the kerite are thoroughly mixed, put into boilers, and allowed to stand until ready for use. When hot the composition is of about the consistency of thick treacle: it is run into cakes, which, when cool, are kept separated by a thin layer of soapstone, in order to facilitate handling. Pure Para gum, cleansed by a process of Mr Day's invention, is then thoroughly mixed with the kerite by the usual grinding operation, and the whole carefully strained. It is afterwards cut into strips about an inch square, and fed into a machine, which covers it on to the wire as the latter passes through. The wire is then coiled in layers in large pans, fine soapstone dust being used to prevent adhesion, and is vulcanized. The coils are afterwards rewound upon "testing reels," and submerged in water for forty-eight hours. The wire is most carefully tested while in the bath, and the process is then complete. Wire for single lines is wound and despatched at this point, while that for cables is wound up for the cable making machines Submarine cables have a coating of prepared tape over each strand, they are then surrounded with an envelope of jute fibre, and, lastly, enclosed in an armour of the best "B. B." galvanized iron wire.

A PROJECT has been started for a ship canal between the Baltic and the Black seas, to cost 120,000,000 marks, or, if made large enough for large war-vessels, as it is expected that Prince Bismarck will insist, 150,000,000 marks. A mark is twenty-four cents. Three fifths of the expense are to be borne by Russia, and the remainder equally by the States of Hanover and Oldenburg and the cities of Hamburg and Bremen. The promoters estimate that the number of vessels that would pass through the canal would be three times as great as the number passing by Suez.

BIDS all rejected.—The Secretary of the Treasury has rejected all the proposals for the superstructure of the new Government building at Pittsburg, because they are all in excess of the amount appropriated by Congress for this building—$700,000.

The Institution of Civil Engineers.

The annual general meeting of corporate members was held on Tuesday evening, the 18th of December, Mr. Brunlees, F.R.S.E., President, in the chair, to receive a report from the outgoing Council on the state and condition of the Institution, and on the principal matters that had engaged their attention during the expiring year.

It was stated in the report that, owing to the policy pursued by successive Councils, the Institution had become one of the most successful and prosperous of scientific societies, not only financially, but also in respect of the amount of professional knowledge diffused by its publications. The constitution was now sufficiently broad to include as corporate members all persons who had acquired eminence in the profession, or who, by their training and experience, were entitled to be considered civil engineers, whatever branch of engineering they might follow. The changes that had occurred in the several classes composing the Institution, irrespective of the students, had included the transfer of 40 associate members to the class of members, and of four associates to that of associate members; the election of one honorary member, 41 members, 223 associate members, and fifteen associates; and the restoration to the register of three associate members. The deductions arising from deaths, resignations, and erasures had been—one honorary member, 33 members, 25 associate members, and 21 associates. The net result, therefore, was an increase of 48 members, and 165 asssociate members, with a decrease of 10 associates, the honorary members remaining the same. The gross number on the books was 3588. as against 3385 twelve months ago, being an increase of 203, or at the rate of 6 per cent. During the session 81 students were elected associate members, and 175 candidates were admitted. The number of students now on the books was 722, as against 707 at the corresponding period last year.

It was stated that the large income now received was simply the result of growth in numbers, and was not due to an increase in the subscriptions, which remained the same as in 1837, when the present scale was adopted, while the material advantages offered had, in the interval, increased tenfold. For five years the accounts had been so set forth as to show at a glance on the debit side the three items of income proper, capital, and trust funds, while on the credit side had also been given under three heads the general expenditure, investments, and trust fund disbursements. Five years ago these totals amounted to 14,230*l.* for receipts, and 14,450*l.* for expenditure; this year they were 17,578*l.* and 17,431*l.* respectively. The excess of income proper for the year 1883 over 1882 amounted to about 5½ per cent.

Last session there were twenty-four ordinary meetings, at which sixteen papers were read and discussed, the President's Inaugural Address occupying one evening. A feature in the Minutes of Proceedings which had not, perhaps, attracted general attention, was the wide geographical range of the countries whose engineering had beendealt with, either in the character of communications read and discussed, of selected papers, or of abstracts from foreign sources. There was no civilized country—from Japan in the far east to California in the far west, from New Zealand to Norway, the public works of which had not been referred to; and in several cases, as for instance the paper on the "Mineral Resources of Tonking," information had been given which, in addition to its professional importance, was of great general interest. In the same way matters of moment to all classes of engineers, to naval architects, and to the great manufactusing industries of the country, were contained in these volumes. On the other hand, several of the communications proved that the reproach, so long levelled against English engineers of neglecting theory was no longer true. The foreign abstracts had also born good fruit in this direction, by indicating the progress of engineering science abroad thus inciting the members to record the result of their original researches. For some of the original communications submitted to the Institution, Telford Medals and Premiums were awarded to Messrs. R. H. Tweddwell, G. H. Darwin, W. Anderson, Major Allan Cunningham, R. E., and A. Leslie. Telford Premiums to Messrs. J. G. Camble, P. O'Meara, Morris, J. Fernie, J. Daglish, Professor Dr. Z. Weyrauch, T. C. Fidler, C. H. Moberly, J. Standfield, W. C. Unwin, J. Harding, and C. F. Tufnell; and the Manby Premiums to Messrs. T. B. Lightfoot and J. Thompson. The subjects treated at the special meetings of students were of a fairly varied character. Of the nine papers then read and discussed two had been thought worthy of printing in the Minutes of Proceedings, and five of the authors had received Miller prizes, these being Messrs. H. J. Eunson, P. V. Appleby, A. Beckwith, T. S. Lacy, and H. H. Parkinson. The Council expressed regret that no paper had been received of sufficient importance to deserve a Miller Scholarship. The Howard uinquennial Prize for 1882 had been unanimously awarded to the late Sir William Siemens in consideration of his important discoveries, and of the valuable improvements he had effected, in the manufacture of iron and steel.

Reference was then made to the course of six lectures on "The Practical Application of Electricity," which had been delivered by as many lecturers, all of whom belonged to the Institution and to the Royal Society, and whose services and those of their assistants were given gratuitously. The Council felt assured that the members would fully appreciate the amount of time and labor required in the preparation of such lectures. These were highly successful and attracted crowded audiences; so much so, indeed, that many persons who wished to be present were excluded for want of accommodation. The Council had arranged for a second series during the current session, on another of the "Great Sources of Power in Nature," namely, "Heat in its Mechanical Application." It was intended that these discourses on electricity and on heat should be printed and issued to the members.

The invested funds of the Institution now amounted to 43,250*l.*, and of those under its charge as trusts to 14,642*l.* together, 57,892*l.* Of these funds 16,893*l.* were in Government 3 per cents., and the remainder in 4 per cent. de benture stocks of the leading British railway companies.

In conclusion, the Council thought that whether regard be had to the primary object of the Institution—the advancement of the science of civil engineering—or whether it be had to the growth of the Institution and to that of its funds, they might be looked upon as having faithfully discharged the trust confided to their care by this corporation.

After the reading of the report, the President presented the Telford Medals, the Telford and Manby Premiums, and the Miller Prizes for 1883, and the Howard Quinquennial Prize for 1882, to the several recipients. The adoption of the report, having been moved and seconded, was, after discussion, agreed to. Cordial votes of thanks were then passed to the President, to the Vice-Presidents and other members of Council, to the auditors, to the secretaries, and to the scrutineers for their several services.

The scrutineers reported that the following gentlemen had been duly elected to serve on the Council for the ensuing year: President—Sir J. W. Bazalgette, C. B.; Vice Presidents—Sir Frederick Bramwell, F. R. S., Mr. E. Woods, Mr. G. B. Bruce, and Sir John Coode; other members of Council—Mr. B. Baker, Mr. J. W. Barry, Mr. G. Berkley, Sir Henry Bessemer, F. R. S., Mr. E. A. Cowper, Sir J. N. Douglass, Mr. C. D. Fox, Mr. A. Giles, M. P., Mr. H. Hayter, Mr. W. Pole, F. R. S., Mr. W. H. Preece, F. R. S., Sir Robert Rawlinson, C. B., Sir E. J. Reed, K. C. B., M. P., Sir W. Thomson, F. R. S., and Sir Joseph Whitworth, Bart, F. R. S.

PERSONAL.

A. M. NICHOLS has been appointed General Superintendent of the Chicago & West Michigan R. R.

J. W. PETHERHAM has just been made Chief Engineer of the Chicago & West Michigan R. R., with office at East Grand Rapids.

CHARLES H. LORING was nominated on Jan. 8, by the President to be Chief of the Bureau of Steam Engineering in the Navy Department.

M. M. TIDD, C. E. is preparing plans and specifications for water works at Hudson, Mass., and at Weymouth, Mass. The work at Hudson is nearly ready for letting.

CLARENCE PULLEN, according to Washington reports of Jan. 9, has the brightest chance of success for the appointment of Surveyor-General of New-Mexico, an appointment to be made in a few days.

GEORGE S. MORISON, M.Am.Soc.C.E., has been appointed by President T. Jefferson Coolidge, of the Oregon Railway & Navigation Co., to investigate the affairs of this Company on the Pacific Coast. He left for the West on January 10.

O. M. SHEPARD, formerly of the New York and New England Railroad, but of late Superintendent of the Shore Line and Air Line Divisions of the New York, New Haven and Hartford Railroad, while retaining these duties has been appointed to the Superintendency of the Hartford and Connecticut Valley Railroad, which crosses both divisions of which he has charge.

CHRISTOPHER C. BALDWIN was appointed by GOV. CLEVELAND, on January 7th, Aqueduct Commissioner, in the place of the late Mr. LANE. Mr. BALDWIN is a New York merchant, engaged in the dry goods business, is the President of the Louisville & Nashville R. R., and Vice-President of an insurance company of this city. He was born about fifty years ago in Waterburg, Anne Arundel Co., Md.; was in the Southern army during the war, and at its close entered into the banking and commercial business in New York.

LEWIS M. RUTHERFURD, a Trustee of the Columbia College, New York, has given his astronomical instruments to the observatory of that institution. They are valued at $12,000, and consist of a 13-inch equatorial refracting telescope; a photographic correcting lens and accessories; two micrometers for double-star work; an excellent transit made by Stackpole Bros., and a fine sidereal clock. The gift was accompanied by a check for $475, to defray expenses of cleaning, polishing, moving and mountiug the instruments.

HENRY VILLARD'S resignation as President of the Northern Pacific Railroad, was accepted by the board January 4th, at which meeting the following resolution was offered and adopted:

Resolved, That the Directors of the Northern Pacific Railroad Company, in accepting the resignation of Henry Villard as President, beg to express to him their deep sympathy in his severe illness, their regret at the causes which have brought about his resignation, their appreciation of his great energy in pushing on the enterprise to a successful completion as a trunk line, that they sincerely hope that he will soon be restored to health and prosperity.

A BOARD of Officers of the Corps of Engineers to consist of Col. John Newton, Lieut.-Col. Henry L. Abbott, Lieut.-Col. Cyrus B. Comstock has been constituted to meet in New York on Jannary 25, for the examination of the following named officers, with a view to their

promotion in the Corps of Engineers: First Lieut. Eric Bergland, Second Lieut. Lansing H. Beach. Upon the adjournment of the board, Lieut.-Col. Abbott will rejoin his proper station, Capt. Carl F. Palfrey, Corps of Engineers, upon the expiration of his present leave of absence, will be relieved by Lieut.-Col. George H. Mendell, Corps of Engineers, from duty under his orders, and will then proceed to Milwaukee and report to Lieut.-Col. David C. Houston, Corps Engineers, for duty under his orders. The leave of absence granted Second Lieut. Robert R. Stevens, Sixth Infantry, has been extended three months. The following changes in the stations and duties of officers of the Corps of Engineers have been ordered: Capt. Thomas Turtle will be relieved from duty under the orders of Lieut.-Col. William P. Craighill, Corps of Engineers, by the last named officer, and will then proceed to New Orleans and relieve Capt. William H. Heuer, Corps of Engineers, of his present duties, reporting by letter to the Secretary of the Treasury for duty as Engineer of the Seventh and Eighth Light-House Districts. Capt. Heuer, on being relieved by Capt Turtle, will proceed to Philadelphia and relieve Col. William F. Raynolds, Corps of Engineers, of the duties now under his charge, reporting by letter to the Sec'y of the Treasury for duty as Engineer of the Fourth Light-House District. Leave of absence to March 17, to take effect upon being relieved from duty as Engineer of the Fourth Light-Hose Districts, has been granted Col. William F. Raynolds, Corps of Engineers.

THE HISTORY AND STATISTICS OF AMERICAN WATER-WORKS.

BY J. JAMES R. CROES, M. AM. SOC. C. E. : M. INST. C. E.

(*Continued from page 632*)

DLXXXII.—MARLBOROUGH, MASS.

Marlborough, Mass., in lat. 42° 25′ N. long. 71° 30′ W. is on hilly ground. The principal business is in the manufacture of shoes.

Settled in 1654, it was incorporated a town in 1660. Water-works were built by the town in 1882-3 after plans of M. M. Tidd, C. E., taking the supply from Williams Pond, a natural lake of 85 acres area and 219 acres water-shed. An earth dam, 180 feet long, 17 feet wide on the top and 8 feet high with slopes of 1½ to 1, and a heart wall of stone masonry is built at the outlet of the pond.

A 16-inch suction pipe extends 114 feet into the lake at 10 feet below the surface, and the water is pumped by a Blake Duplex Compound Condensing Engine, with pumps of 2,000,000 gallons daily capacity, through 1,400 feet of 14-inch pipe to a reservoir on Sligo Hill, 165 feet above the pumps and 217 feet above the town 200 by 275 feet in dimensions and 15 feet deep, built in excavation and embankment, and holding 5,000,000 gallons. The pumps will deliver directly into the mains if required.

Distribution is by 10.5 miles of cast iron pipe of 14 to 6 inch inch diameter, with 131 fire hydrants, 95 gates and 350 taps. Service pipes are of cement lined wrought iron.

The population in 1880 was 10,127. The works which went into operation on June 29, 1883, have cost $200,000 which is the bonded debt at 4 per cent. interest.

The works are managed by three Water Commissioners. Elbridge Howe is Chairman of the Board.

DLXXXIII.—NORWALK, CONN.

Norwalk, Conn. in lat. 41° 6′ N. long. 73° 30′ W. is near the mouth of the Norwalk River on Long Island Sound. It was settled in 1640.

Water-works were built in 1872 by the borough after plans of Geo. H. Bailey, C. E., and under superintendence of J. F. Burgin, C. E., taking the supply from Silver Mine stream which has a water-shed of about 20 square miles. A storage reservoir is formed on the stream by a stone masonry dam 230 feet long on top and 32 feet high, 10 feet of which is below the bed of the stream. It is backed with earth. The reservoir holds 60,000,000 gallons and is 292 feet above the tide level. A 12 inch cement lined wrought iron pipe conveys the water 6 miles to the distributing reservoir on Step Hill, 192 feet above the tide level. This is circular, of 260 feet diameter at water surface, 16 feet deep, constructed in excavation and embankment, with slopes of 1½ to 1 and a puddle wall in the centre of the bank and the inner slope lined with rip rap. The water is filtered through sponge in the gate house.

Another storage reservoir was built in 1883 on the stream 6 miles above the first reservoir under superintendence of George W. Cram The dam is 30 feet high and 125 feet long, built of earth and stone masonry, flooding 14 acres and storing 60,000,000 gallons.

Distribution is by 11 miles of cement lined wrought iron and 6 miles of cast iron pipe of from 16 4 inches diameter, with 105 fire hydrants, 70 gates and 450 taps. Service pipes are of cement lined wrought iron.

The population in 1880 was 5,308. The daily consumption is not known. The works have cost $240,000 and are managed by two water commissioners. No reports are published by them, as far as can be ascertained. Dudley P. Eby is a Water Commissioner.

ALUMINUM.

Wonderful Discoveries in the Use of This Metal.

Aluminum, with one exception, is the most abundant of all the metals. It is a white metal like silver, and might be taken for it were it not much lighter, bulk for bulk. The clay, or alumina, from which it is made, is not found in any particular spot or country. It exists everywhere. More than half a century has passed since that eminent German chemist, the late Frederich Wohler, who for fifty years was Professor of Medicine and Director of the Chemical Institute at Gottingen, discovered the then noble metal aluminum, and that it could be produced from common clay and also from alum, and yet it is among the least familiar of metals. Its usual price is $20 a pound, and until the last year it has only been known as "aluminum gold." After many experiments, extending over a series of years, its production was abandoned, except in one instance, to the French, who only produced it in inconsiderable quantities. After more than thirty years, and at a cost of more than $250,000, the celebrated English chemist and metallurgist, James Webster, has discovered a method of making aluminum by burning or roasting alum, instead of making it by the old way, by precipitation. By the old process it took six months to do what is now done in six days. Mr. Webster has produced 200 pounds of aluminum per week for more than a year, valued at $4,000, or $208,000 per annum—the result of which has been that at the present time a factory which covers more than half an acre is kept busy night and day, with orders ahead for fifteen months. The output at the present writing is twenty tons of aluminum metal a week.

From the success already obtained by the alumina bronze manufactory (near Birmingham) it is plainly evident that in a very short time this almost new and peculiar metal, which never oxidizes, tarnishes, or changes under any circumstances; to which can be given the color of gold, silver, purple or bronze; and which differs from all other metals in that it is never produced direct from ore, but instead only by a long and elaborate process, must become an important factor in the manufacture of jewelry; and not only this, but that almost every article made from metals, from the ponderous screw propeller, anchor, or cable of the largest ocean steamship down to the tiniest needle, must be made from it or its bronzes. The chief value of aluminum at present is in tempering or giving strength, flexibility, toughness, and a body and surface to alloys, bronzes, or metals, so as to combine strength with lightness, and so that they will not corrode. Thus far in its use only enough of it is present, even in the bronze(1-1700), so as to soften or mollify the brittle or hard nature of the base metals of which it is composed. To copper, tin, or zinc it gives such properties as can be obtained by no other means, softening their nature, while increasing their real hardness and strength, and enabling them to withstand all the tests applied to gold or silver, preserving the alloys from corrosion, and rendering them more ductile and refined, giving them a body and surface that withstand the chemical action of the elements.

As one result of this new process of making aluminum, all plated goods must give way to those made of solid aluminum or bismuth bronzes. Pianoforte wire made from it vibrate ten seconds longer than the best now in use. The tensile strength of these bronzes—the two being the same, except in the bismuth bronze 1-1800 part of bismuth is added—has been proved by the repeated tests to bear a strain of forty-two tons to the square inch, or fourteen tons more than gun-metal, and twelve tons more than the best Bessemer steel. Whenever and wherever there is need of a metal that cannot corrode under any circumstances, one that combines great strength and flexibility, it is plain that aluminum must be used. In the tests made with propeller-screws, blades, and heavy artillery, made from aluminum or bismuth bronze, as against those made from the best gun metal, the steamship-builders decided at once in favor of the former, as the strength was so much greater and the weight so much less, being only one-quarter as great. The same metal or bronze for piano and telegraph wires has no equal on account of its tensile strength, toughness and weight. For table, stove, or kitchen ware and utensils it is superior to all other metals, as it is always bright, is very hard and durable, polishes well and easily, always retaining its brilliant lustre. Aluminum bronze has been made into and tried in pots, kettles, dishes and pot covers, tea-pots, jugs, crucibles mortars, watchcases, cups, saucers, plates, spoons, knives and forks, milk and sirup pitchers, soap-dishes, wash-basins, spittoons, brush-trays, dressing-cases, and other toilet articles, gun and pistol barrels, handles and trimmings harness, carriage, saddle and bridle trimmings and ornaments, and many other articles made of nickel, brass, silver, gold, bronze, iron, or steel; and prove a success in all. Octants, sextants, chronometers, compasses, and other instruments used for marine observations and service are made of aluminum bronze, and stand the tests of sea-air and water as no other metal does.

Monier, the French chemist and metallurgist, once said he would yet produce aluminum for seven cents a pound. Another well-known metallurgist says that he can produce it for 14 cents a pound. The public will wait with interest to see them do so. The exact cost of a ton by Mr. Webster's process is not given, nor the number of tons of alum required to make one ton of aluminum.

A Southern Railroad President in a Fix.

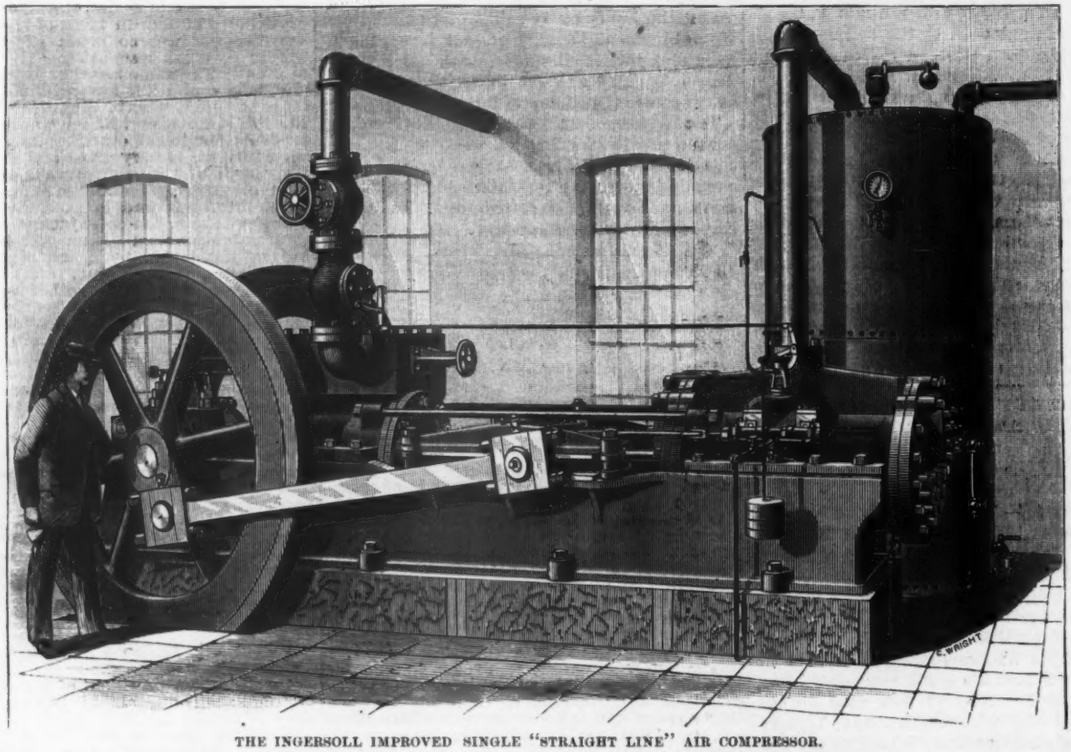
A well-known president of a Southern road distinguished himself in Chicago recently. He was bound for New York, and when he showed his pass at the depot gate it was promptly taken up, the bearer being referred to the general passenger office for any explanation he might want. Only a few minutes till train time remained, and he hastened into the general passenger office fuming with rage. "What does this fellow outside mean by insulting me, sir, by depriving me of my pass, sir?" he demanded angrily. "Does he think I stole it, or that I've been trying to sell it, sir? I tell you I have been grosely insulted and I want an explanation." He was urged to be calm and to state his case a little more plainly, and whatever wrong had been done would be righted. After he had acquainted the agent with his name it was at once recognized as having graced a pass that had been offered for sale in a scalping shop a few days before. The matter had been reported at the office, and the gatekeeper had been instructed to take up a pass bearing that name. The Southern railroader then explained that he had lost his return pass, which some one had probably found and tried to sell. He was able to indentify himself without difficulty and was then given a note to the gatekeeper for a return of the pass. In the meantime his train had gone, and boiling over with rage he appeared a second time in the agent's office, when he proceeded to heap upon the head of everybody connected with the road a choice assortment of Southern invectives. Having thus unburdened himself, he pettishly tore his pass into fragments, and throwing the pieces on the floor savagely exclaimed: "There, blank you! I'd walk to —— and back before I'd accept another pass from your blankety blanked old road!" With that he took himself out of the office.—*Chicago Times.*

A CORRESPONDENT in the Government Engineering Laboratory, College Howrha, Bengal, writing in reference to the discoloration of brick walls, says that in three samples of white incrustation he found the substances to be mainly potassium nitrate with a trace of magnesium nitrate.

The Ingersoll Improved "Straight Line" Air Compressor.

The Ingersoll Improved "Straight Line" Air Compressor, shown in the accompanying illustration, although new, has already taken a position among the standard machines of this class with the eastern mining public. It has been tested in competition with other compressors—both single and duplex—with most satisfactory results.

When a large volume of air is required, it is both better and safer to depend on two or more single machines, rather than upon one duplex compressor. The machine may be described and its principles explained as follows:



THE INGERSOLL IMPROVED SINGLE "STRAIGHT LINE" AIR COMPRESSOR.

Each machine is complete in itself and independent; the steam and air cylinders are in line, and, with the fly-wheels, are carried on one continuous frame, making it impossible for any part to work out of line. *All strains are direct.* The line of resistance passes between two heavy balance wheels, which store the power during the first half of the stroke, and release it at the end or point of greatest resistance. Considering all points, a greater percentage of the motor power can in this way be applied at the point of greatest resistance, than with the duplex system. Again, if two Single Compressors are running together, and one is temporarily disabled, it can be cut out *instantly*, without affecting its mate, by simply closing the throttle valve; and the speed of the other safely increased forty to fifty per cent. (owing to the points of construction mentioned above.) The underground work will not be interrupted, nor the Compressor injured by its short term of hard duty. You have also two independent compressors, ready to separate and run whenever required. Should the engine stop on its centre, it is thrown off by the perfect regulating device. No "baring over" is required. Thus the only point that can be advanced in favor of duplex compressors is overcome. With a Duplex the main shaft is subjected to a tortional strain every revolution. This increases the friction and inevitably causes some part to work out of line. It is impossible to safely run at a high speed. If one side becomes disabled all work is stopped while it is being disconnected and the other side is left in a crippled condition to do what it can—like a locomotive with one of its cylinders gone.

The system of cooling by injecting water into the interior of the cylinder against pressure, i. e., in a spray, while the heating due to compression is going on, maintains the air at nearly its normal temperature, it is then discharged into the receiver, under water, at a sufficiently low temperature to prevent vaporizing the water, and from the receiver it rises robbed of moisture (as water has an affinity for its like) and passes into the conducting pipe practically dry, that is if the proper quantity of water is used in the cylinder, and the receiver is properly constructed and arranged. The inner surface of the cylinder is cool when the free air passes in, and consequently the air is at atmospheric pressure when compression begins. The water lubricates, fills all clearance spaces, and passes the discharge valves after the air; thus clearing the cylinder of the entire volume of air compressed. The correctness of this system is proved by the well known fact that the absorbing capacity of air is greatly increased by every degree its temperature is raised.

Unbelievers can be referred to numerous practical illustrations of this system, where far better results are obtained than from Compressors using the water jacket system, in which the water circulates more or less regularly between an inner and outer cylinder keeping only the outer shell cool. It is impossible with any system of water circulation to effectually absorb the heat developed by compression. This is proved by the hot discharge pipes invariably found on Compressors of this type. As a consequence the inner surface of the inside cylinder is always hot ready to expand the incoming air and prevent the filling of the cylinder with air at atmospheric pressure, the clearance spaces are filled with air at high pressure which is not discharged, but expands back as the piston reverses. This operation is repeated each revolution, and results in a large aggregate loss. Air always carries more or less moisture with it, which is deposited in the receiver, where it comes in contact with, and is vaporized by the hot air, and passes out to condense and freeze, either in the pipes or exhaust ports of the machine.

The compounding of air cylinders for any pressure under two hundred pounds is worse than useless, as there is excessive loss due to the clearance spaces in two cylinders, and the friction in the connecting passage. There is also the unnecessary expense of keeping two extra sets of valves in order. The same result is accomplished by simply making one steam and one air cylinder of proper relative proportions.

The adoption of the Ingersoll Single "Straight Line" Compressor by such concerns as the Franklin Iron Manufacturing Co., Clinton, N. Y., and J. & J. Rogers Iron Co., Ausable Forks, N. Y., Mount Hope Mining Co., Mount Hope, N. J. (one of the Lackawana Iron & Coal Co. mines) is a guarantee of its merit. After careful examination of all Compressors now in the market, four of these machines 24x30 in. cylinders, were selected for the Washington, D. C. aqueduct tunnel, 4¾ miles long, referred to in the news column of this issue.

STONEWALL'S BRIDGE BUILDER.—A useful man to Stonewall Jackson was old Miles, the Virginia bridge builder. The bridges were swept away so often by floods, or burned by the enemy, that Miles was as necessary to the Confederate army as Jackson himself. One day the Union troops had retreated, and burned a bridge across the Shenandoah. Jackson, determined to follow them, summoned Miles.

"You must put all your men on that bridge," said he; "they must work all night, and the bridge must be completed by daylight. My engineer shall furnish you with the plan, and you can go right ahead."

Early next morning Jackson, in a very doubtful frame of mind, met the old bridge builder.

"Well," said the general, "did the engineer give you the plan for the bridge?"

"General," returned Miles, slowly, "the bridge is done. I don't know whether the picter is, or not."

THE actual cost of making a ton of iron in the Lehigh Valley, Pa., is put down by Mr. McCreath, chemist of the Geological Survey of Pennsylvania, at $20.38, itimized as follows: Ore $9.34: coal, $5.30; limestone, 77 cents; labor, $2.33; incidentals and repairs, $2.64.

NEWS OF THE WEEK.

Water, Gas and Steam.

WASHINGTON (Pa.) has a recently organized People's Light, Heat and Fuel Company; it proposes to drill wells for the purpose of striking a flow of natural gas, if possible, with which the town will be lighted. The McGugin gas well, which sends out gas enough to light several cities as large as Philadelphia, as estimated, and which is now being piped to Pittsburg, is located within twelve miles of Washington.

GROUND has been broken for the extension of water pipes from Greenwich, Conn., to Portchester, N. Y. Wm. B. Rider, of S. Harwalk, Conn., is engineer in charge. Mr. R. has just completed the Orange, N. J., water-works.

THE Chicago *Tribune* says that the receipts of the Chicago water-works for last year were $1,266,420, an increase of $100,000 over the previous year.

THE water board of Minneapolis, Minn., decided at its meeting of Jan. 4. to have an expert test of the new 10,000,000 gallon pumping engine in that city. Two additional pumps of the same pattern are said to have already been ordered by the board.

THE town of Moline, Ill., is just about to start its new water-works. The pumping machinery, having a capacity of a million and a half gallons in twenty-four hours, was supplied by the Deane Steam Pump Co., of Holyoke, Mass. It consists of one compound condensing pump for the lower part of the town, and a smaller compound pump for the "cliffs."

THERE has recently been shipped to the North Chicago Rolling Mill Company, for their steel-converting works at South Chicago, the largest heavy-pressure pumping engine ever made in the West. The steam cylinder of this engine is 32 inches in diameter by 3 ft. in stroke, operating on a water-cylinder 11½ inches in diameter. The engine weighs 13½ tons, and is 37 feet long over all.

DURING the past year the water service pipes of Malden, Mass., have been extended through thirty-five streets of the city, and the total amount of new pipe laid is 8,176 feet. There have been 172 new services entered, making a total of 2,804 services, and 39 miles, 5,080½ feet of pipe laid throughout Malden—which shows the constant increase of demand on the water supply. The water at Spot Pond is now 82 inches below high water mark, being 19 inches lower than it ever has been since the pipes were laid. Owing to this low state of the water the city is now dependent upon the pumping service at the pond, which is maintained at a cost of $10.50 for every twenty-four hours. The total cost to Malden thus far for this extra pumping system has been $8,000—of which amount $4,000 has been incurred the past year.

Another large tunnel just started is that of the Washington D. C. Aqueduct for the new water supply of the National Capital. This is a Government, work but the tunnel, dam, reservoir, etc., have been let by contract the work to be done under supervision of United States Engineers. Beckwith & Quackenbush were awarded the contract for the tunnel, 4¼ miles long, and they have already broken ground and commenced sinking shafts which will be necessary in order to work as many forces as practicable and complete the tunnel in the quickest possible time.

The entire plan of machinery for this work consisting of six 100 horse power boilers, four 24x30 inch single "straight line" air compressors, twenty-eight 3½ inch Ingersoll "Eclipse" Drills, five pumps, etc., is being furnished by the Ingersoll Rock Drill Company of New York. This is the largest plant ever erected for a similar purpose, and the selecting of the machinery for this important government work was done with the greatest care.

The compressor plant is to be located at a central point, the boilers and compressors, being set up in a battery, and the air carried five miles through 12, 10 and 6 inch pipes, to the head of the four shafts, where it will be received by 4 inch pipes and supplied to twenty-eight Ingersoll drills, necessary hoisting engines, pumps, etc. When the tunnel is completed the air will have been carried through ten miles of pipe.

Streets, Drainage, Sewerage, Etc.

MAYOR FRANKLIN, of Newport, R. I., in his inaugural address of January 7th, advocates a Board of Health and an improved sewerage system as arranged by the City Engineer, and which is to cost about $50,000. He also recommends considering plans for a new City Hall.

SAN ANTONIO, Texas, wants sewers, and Major Humphreys, C. E., of Memphis, Tenn., has been employed to investigate the matter. Maj. Humphreys submitted his report on the 31st ult., in which he recommends the "separate" or Waring system. Thirty-six miles of sewer pipe and 475 flush tanks will be required. The total cost including engineers' salaries, is estimated at $325,000, and one year's time will be required to complete the work.

ACCORDING to the Chicago *Tribune* there were constructed in 1883 in that city 75,364 feet, or about fourteen and a quarter miles of sewers, the dimensions being: Twelve-inch pipe, 27,707 feet; fifteen-inch pipe, 16,093 feet; eighteen-inch pipe, 3,245 feet; two-foot brick, 7,922 feet; two-and-a-half-foot brick, 3,543 feet; three-foot brick, 1,545 feet; three-and-a-half-foot brick, 1,453 feet; four-foot brick, 4,017 feet; five-and-a-half-foot brick, 1,395 feet; six-foot brick, 2,134 feet; six-and-a-half-foot brick, 2,132 feet; nine-foot brick, 4,178 feet. The cost was about $185,000.

IN reference to complaints made by residents of Beacon Hill and the West End (Boston) that cellars were flooded during the heavy rainfall of last week and the new intercepting system failed to relieve them, the City Engineer desires to have it understood that the new system was not intended to provide for such emergencies, although practically it has met them in every section of the city except Beacon Hill and the West End, where connection has not been made with the intercepting sewer which runs through the Back Bay park. At a comparatively small expense pipes can be laid from houses to the sewers to carry off the storm flow even at high tide when under the former condition of things the sewers were full, but which now can be emptied at any time by putting the pumps in operation at Old Harbor Point.—*Boston Journal.*

Bridges.

AMONG the 674 bills introduced in the House on January 8, was one by Mr. Beach, of New York, to authorize the construction of a bridge across the Hudson River between Storm King and Break Neck Mountains.

IT is announced that the officers of the Oregon Transcontinental Co. have made arrangements for a loan of $8,000,000 with which to wipe out its floating debt.

A SPECIAL session of the Councils' Highway Committee of Philadelphia was held Jan. 7, to open proposals for building a complete granite bridge, one hundred feet in width, over the Schuylkill River at Market Street. Bids were also opened for constructing the foundations, piers and abutments in separate items, and for the erection of a wooden temporary bridge North of the present one. The approaches to the Eastern end will begin at a point 265 feet West of Twenty-Third Street, and at the Western end 440 feet East of Thirtieth Street. Prior to considering the first bid, Chief Commissioner Estabrook announced that in compliance with the ordinance all proposals would be submitted to Councils after being scheduled by the committee.

For the stone bridge complete and its approaches the following bids were received: H. Clark & Co., New York, $1,160.000, in sixteen months' time; Lindenthal & Friday, Pittsburg, $1,320,000, in thirty months; R. A. Malone & Son, of Lancaster, $1,000,000 in eighteen months; and E. S. Smith & Alexander McGaw, 410 Walnut Street, Philadelphia, $1,197,132, in twenty months. The proposal of Lindenthal & Friday was not considered, as they failed to offer the security required by the specifications, and Clark & Co. asked that their bid for the temporary structure be withheld should they not be found the lowest bidders for the stone bridge. Smith & McGaw were the only contractors bidding on the wooden bridge, which they engaged to build for $55,000 in four month' time.

For the Western abutment pier and abutment of the stone bridge the bids were: Lindenthal & Friday, $202,000; Malone & Sons, $134,187; Smith & McGaw, $145,380. For the West river pier. Lindenthal & Friday, $118,000: Malone & Sons, $89,959; Smith & McGaw, $114,490. For the East river pier, Lindenthal & Friday, $76,000; Malone & Sons, $53,344; Smith & McGaw, $87,250. For the East abutment pier, Lindenthal & Friday, $78,000; Malone & Sons, $44,025; Smith & McGaw, $52,535. For the East abutment, Lindenthal & Friday, $31,000; Malone & Sons, $27,125, and Smith & McGaw, $30,076.

The committee decided that only the bids put in proper form should be scheduled, but they, with the others improperly offered, should be sent to Councils as a matter of information. —*Phila. Times.*

Contracting Miscellany.

Two schemes are now before Congress looking to the establishment of a Bureau of Labor Statistics; to make an annual report on the general subject of labor.

THE report printed by the *Age of Steel*, that a monster iron pool is forming, embracing the entire pig-iron industry of the country, is strenuously denied by the iron men of Philadelphia, and by Secretary Swank of the American Iron and Steel Association; it is called absurd.

THE Mississippi River Commission have just completed the topographic and hydrographic survey of the Mississippi River below Memphis. The surveying party working near Helena, Ark., was disbanded on December 28th.

The Telegraph of this city says that the Faraday cable ship will leave in the last week of this month for Dover Bay, whence she will lay the first five hundred miles of the new Atlantic cable of the Messrs. Mackay & Bennett. She is then to return to Dover Bay and lay the section between Nova Scotia and Cape Ann, Mass. By the end of May the Faraday is expected to leave England again with the remainder of the cable needed to complete the line of the Commercial Cable Co., between England and America.

SECRETARY SWANK, of the American Iron and Steel Association, is preparing his annual report of the iron and steel trade of the United States for 1883. He says that he is able now to estimate closely the year's production of pig-iron, which he puts down as equal to that of 1882, 4,623,323 tons. The consumption of pig-iron has been about 4,948,323 tons. The year was begun with 383,655 gross tons of domestic pig-iron unsold. There were imported during the year 325,000 gross tons, all of which has gone into consumption. Adding the estimated production of 4,623,323 gross tons to the estimated importation, and taking no account of the balanced stock at the beginning and end of the year the total, 4,948,323—the year's consumption—is found to be the result. The production of steel rails in 1883 has fallen off below that of 1882. There were also made probably 100,000 tons less iron rails than in 1882. The total rail tonnage of 1882 was 1,501,881 gross tons, of which 203,459 tons were iron rails and 1,304,392 tons steel rails. The total rail production for 1883 has been probably, 1,300,000 gross tons, of which 1,200,000 tons were steel rails. Our imports of steel rails for 1883 has been about 100,000 gross tons as against 200,000 tons in 1882. In round numbers our consumption of rails in 1883 has been 300,000 tons less than in 1882.

THE City Councils of Boston have appropriated $10,000 for premiums for the best four plans for a new building for the public libary. The following preliminary description is issued by the Trustees, all plans to be in by June 1st, 1884: "The Trustees decide that the building shall be of brick, three stories in height above the basement, with brown stone trimmings. The cost is not to exceed $450,000. The building will front on Dartmouth street, with a width of a little more than 200 feet, and extend back on Boylston street and St. James avenue about 160 feet; and there will be two main entrances, one at the junction of each of these streets with Dartmouth street. In the basement which will have three-quarters of its height above the level of the sidewalk, there will be, in addition to the apartments of the janitor and other rooms for special purposes, a room, with an area of 3,000 square feet, where the bound newspapers will be kept and may be consulted, and a bindery with an area of 2500 square feet. The other three stories will be finished of a uniform height of fifteen feet. On the first floor, fronting on Dartmouth street, will be two rooms, of an area of not less than 2500 square feet each, one for the patents and the other for the English and American public documents. On the second floor will be the great hall, containing the delivery desk and reading room, with an area of 7500 square feet; the public card catalogue room, with an area of 2250 feet, rooms for the Trustees and the librarians, and dressing rooms and other accommodations for persons employed in the library The third floor will be mainly used by cataloguers and other persons engaged in the regular work of the library, but it will also contain an art room with on area of 3000 square feet. Rooms also will be provided for the special libraries. The book stack is to be seven stories in height, and is to be built throughout of iron, and to have a shelving capacity for 700,000 volumes. It will be constructed on the same general plan as the new part of the college library at Cambridge, but with some slight modifications to increase the light and to facilitate access to the books."

Railroads.

BOSTON, Jan. 7.—The Nantasket Beach Railroad was sold at auction to-day for $100,000 to satisfy the claims of its bondholders. The purchase was made, it was understood, in the interest of the bondholders.

OTTAWA papers say there is little likelihood of the construction of the projected railroad from Cornwall, Ontario, to Soul Ste. Marie, there to join the Northern Pacific R. R.

A GALVESTON dispatch of Jan. 4, says that on that day the Mexican International R. R. entered Monclova, 144 miles from Eagle Pass. It is thought that construction on this road will stop there for an indefinite time.

THE Keystone Railroad Co., and the Philadelphia Rapid Transit Co., propose to build an elevated railroad in Philadelphia, from Cobb's Creek and Market street, in West Philadelphia, across the Schuylkill to Seventh and Market, then branch north to Third and Berks, and south to Wharton street.

APPLICATION was made at the Pa. State Department on January 5, for a charter to the Pittsburg and Allegheny Central Railway Company, capital stock $1,200,000. The company proposes building a railroad from Chartiers Township, Allegheny County, to New Salem, Westmoreland County, a distance of 40 miles.

THE Trenton *Times* of January 3, says: "The Reading Railroad has notified all of its employes holding public positions to resign their offices or leave the company's employ. Among the employes affected by this order are two members of the incoming Legislature, Even those employes who hold the office of School Trustee have been forced to resign."

A DISPATCH from Altoona, Pa., says: "The twenty-year lease of the Pullman Palace Car Company to the Pennsylvania Railroad Company will expire shortly; and in view of this fact the latter company is making arrangements to construct elegant cars for its own use." This may be one cause for the weakness in Pullman stock,

THERE is every indication that the Pennsylvania Railroad will extend its Schuylkill Valley branch to Pottsville and connect at that place with the Lehigh Valley Railroad, both companies occupying the same depot, which will be erected on Coal and Norwegian streets, on the property recently purchased by the Pottsville & Mahanoy road.

AN earnest effort is again being made by Mr. Charles Stoughton to have Congress authorize the Secretary of War to contract with him for the improvement of the Harlem River. The plan proposes to construct a channel from the Hudson River to or near the end of Randall's Island for a sum not exceeding $1,295,000. The channel is to be 225 feet wide and 15 feet deep at mean low tide and to be completed on or before Dec. 31, 1885.

WORKMEN engaged on the Bozeman tunnel of the Northern Pacific railroad in Montana came together December 22, and it is expected that track will be laid and trains run through by January 10. The tunnel is 3,610 feet in length, 17 feet wide and 21 feet high in the centre. Work on the approaches was begun in the fall of 1881, and on the tunnel proper in the spring of 1882. From 80 to 100 men have been employed constantly on the work, and the total cost when completed will be about $300,000.

A DISPATCH to the Chicago *Journal* from Springfield, Ill., says the incorporation of the Lake Erie & Mississippi Railway Company was effected there on Jan. 7, with Columbus B. Cummings, George A. Ives, John B. Cohoes, and Luther M. Dearborn as incorporators, and who constitute the first Board of Directors. The company is formed to construct a road from Bloomington to Peoria, Ill., and thence westward to the Mississippi.

THE Governor of New Jersey, in his annual message, sent in on January 8, says that the investment in railroad property in that State amounts in a carefully prepared estimate to $227,384,534. The tax levied upon railroads last year was $677,557.76, which is less than one-third of one per cent. Other property in the State is taxed at rates varying from one to three per cent.

A MEETING of the stockholders of the North River Construction Company, which is building the New York, West Shore & Buffalo Railway, was held at Weehawken, January 8th. The following Directors were elected: Edward F. Winslow, Charles Freeman Smith, Michael P. Grace, Thomas W. Lillie, Walter Katte, Howard Mansfield, and George G. Nevers of New York; Conrad N. Jordon, of Englewood, N. J., and Charles Bard of Norwich, Conn. The voting was by proxy mostly. The stock in trust controlling the company was voted by the Trustees. No statement of the condition of the company was presented.

THE Pennsylvania Railroad Company has purchased the Eastern Shore Railroad at a price approximating $450,000. The Eastern Shore Road runs from Delmar, Del., to Crisfield, Md., a distance of 38 miles.

THE excavations from the east and west ends of Gould's Tunnel, near Steubenville, Ohio, have met about 2,300 feet from the east end. The tunnel is completed for about 2,000 feet in the east end and 800 feet in the west end. It is nearly four years since the work was commenced, and 300 men have been employed on it night and day. It will be 3,300 feet long, and will do away with the most dangerous curves on the Panhandle Railroad, saving about 2¼ miles of travel. It is expected the tunnel will be completed in February.

THE Reading R. R. Engineers are locating lines in Pottsville, Pa., with a view of preventing if possible, the entrance of the Penn'a. R. R. into that city. It seems that approach from the south is only possible on two streets, one is entirely occupied by the Reading R. R. and the other is now being located upon. The rival engineer corps of the Pottsville & Mahony new branch, in the Penn'a R. R. interest also arrived on the ground on Jan. 3, and both parties are busily at work.

WASHINGTON, Penn., Jan. 7.—Contractors will be at work in a few days on the extension of the Hempfield, Baltimore and Ohio Railroad between Washington and Connelsville, a portion of the work having been alreadv let. The remainder will probably be awarded this week. The first work will be at Brady's Tunnel, a short distance from here, which was begun but abandoned 10 or 12 years ago. It is considered in a dangerous condition. When finished this line will give the Baltimore and Ohio a shorter line between the East and West.

THE annual report of the Railroad Commissioners of Massachusetts was submitted to the legislature Jan. 7. During the year ending September 30, 1883, there were 3,798 additional miles of railway constructed in the State. The aggregate capital stock was $122,367,572. The net debt of the companies amounts to 72,933,290. The total gross income for the year was $43,380,387; total expenses, $32,479,907. The local passenger earnings were $13,652,320; through passengers carried was 61,530,747. The whole number of tons of freight carried was 20,202,881. The number of persons injured during the year was 524 and the number killed was 191, 15 being passengers. Upon the Sunday train question the Commissioners say that to authorize a Sunday train on an abstract argument against Sabbath observance without proof of any demand for the train would show disregard of the spirit of the law passed in 1881, and would be a breach of trust. There is no doubt that the law should be constrcted as authorizing permission for the operation of a road when it is called for by mixed considerations of convenience and necessity.

SOUTHERN RAILROAD NOTES.—Steps are being taken to build 50 miles of lines from Baltimore to the Virginia Midland at Alexandria.

It is reported that a syndicate intend to build a road from Linwood, Rockingham Co. Va. and the Shenandoah Valley R. R., to Harrisonburg, twenty miles and then westward about one hundred miles. It is in the interest of the Dora coalfields and Baltimore owners.

A charter has been secured for a road from Mound City, Ark., five miles above Memphis, to the St. Francis River, near Wiltsbury, twenty-six miles.

The Fort Smith & Hot Springs R. R. has secured a charter; it is ultimately to proceed south to connect with New Orleans lines. A survey has been made.

It is proposed to build a railroad from Danville, Va., south-east into Caswell Co, N. C., thence east to Middleburg on the Raleigh & Gaston R. R. a total distance of about twenty miles.

WORK on the approaches of several of the large tunnels recently let on the line of the new South Penn. R. R. has been commenced in good earnest by the contractors, most of whom are already on the ground, and they propose to lose no time in getting to their headings, which will be driven in from both ends of each tunnel simultaneously.

The most improved drills and other tunneling machinery will be used on this work as the time for the completion of the tunnel is limited so that very rapid progress will be necessary if they are to be finished in time.

The contractors on the Allegheny, Sidling Hill and Kittatiny tunnels have already placed their orders with the Ingersoll Rock Drill Co., of New York, for the necessary plans of machinery, so there will be no delay in having all the requisite appliances on the ground and ready for work by the time they are needed.

The driving of these tunnels will be watched with considerable interest by railroad contractors and others, because from the experience and reputation of the men who have charge of the work and the character of the machinery they propose to employ, some very "tall' driving is expected. The tunnels are double track, 27 feet wide by 22 feet 6 inches high, and their total length exclusive of approaches is 36,160 feet, or nearly seven miles.

IRON, METAL AND COAL MARKETS.

PHILADELPHIA, Jan. 10, 1884.

There was a better feeling in the Eastern Pennsylvania iron trade during the past week, owing to the fact that stocks at furnace-banks and in consumers yards, are found to be even lighter than was supposed, and also to the fact that inquiries for all kinds of Iron are coming in more freely. Foundry Iron is quiet and dull at $20.50@$21. Forge is in rather better request at $18@$18.50 for good brands. Bessemer and Spiegeleisen are under active inquiry. Bessemer is quoted at $20@$20.50. Some large lots of Spiegeleisen are under negotiation at $28.50@$29. Most of the Steel Rail mills are well supplied with business and are refusing to accept the prices which were willingly taken in December. Quotations are now held firmly at $35 for prompt and $34 for future delivery, and large transactions will probably be closed within a few days. 20,000 tons are under negotiation at $34.50 asked. Manufactured Iron is in a little better request and is quoted at $1.80@2c. at mill, though small store lots commanded in some cases $2.10. Nails are firmer at $2.45@$2.55. Structural Iron is under active inquiry and a large amount of business is likely to be placed for elevated road requirements.

CHICAGO, Jan. 9, 1884.

Dullness is the general characteristic of the iron trade of this section, but some dealers report that they have received a fair number of inquiries for this year, and some of them from large consumers who will shortly be in need of heavy stocks. Some buyers have offered to place orders for Iron to be delivered throughout the year at present quotations, but as makers have strong faith in an early improvement in demand and in price, these offers have not been accepted. The trade in Manufactured Iron is quiet. Bars are quoted in ordinary jobbing way on the basis of 2c. Structural Iron is quiet at $2.60 for Tank; $2.70 for Angle; Beam, $3.60; Channels, $3.80; C. H. No. 1 Flange, $4.50; C. H. No. 1 Shell, $3.50. The suspension in nail making has imparted strength to prices. Former quotations are continued at $2.55@$2.60. A fair number of small orders for Pig Iron have been placed, and there are inquiries for large lots. Heavy purchases will probably be made within a short time. There are indications that an improvement will take place in Lake Superior charcoal brands. Demand for Steel of the higher grades is reported fairly active, but prices for lower grades have been badly cut. Scrap Iron is dull. Quotations unchanged.

PITTSBURGH, Jan. 10, 1884.

There has been little change in thes ituation the past week and business is about as dull as ever, but iron men are hopeful that there will be an improvement within a week or two. Stocks are light in first and second hands and consumers, as a rule, will have to come into the market within a very short time. City furnaces are holding standard brands of Lake-ore Forge Iron at $18, four months, and refuse to sell for less, but equally good irons from outside furnaces can be had at $17 cash. Foundry Iron is in light demand at $18@$21 but a small sale of Charcoal Foundry has been reported at $25. Nails are firmer at $2.40@$2.50. No sales of Muck Bar have been reported for several weeks. All the Merchant Bar mills have resumed and are working to about three-fourths capacity. Prices are quoted at $1.70@2c. Steel rails are under better inquiry and are quoted at $35@$36 according to date of delivery. Bessemer Pig, $21@$21.50.

COAL.

PHILADELP , Jan. 10, 1884.

In consequence of the agreement to suspend Anthracite mining for three days each week, in the first three months of the year, the demand for domestic sizes has become more active. Western shipments continue, but are much lighter than formerly. Stocks of Coal are very large, and are not diminishing. It is now believed that the half-time output will be quite sufficient to fill current requirements; by this policy the companies hope to enter the spring trade in splendid condition, and hope to even be able to advance prices slightly. The Reading is quietly but surely extending its control; last week it took possession of several of its leased collieries The production of Anthracite Coal for 1883, is 31,359,338 tons as against 29,120,006 tons for 1882. Total receipts of Anthracite at Chicago for the yea, 1,138,0?? tons, an increase of 38,000 tons over the previous year. Total receipts at Boston from New York and Philadelphia, 1,722,642 tons, a decrease of 30,554 tons. Some shading of prices is going on, but as a general thing, prices are being pretty well maintained. There is no improvement in the bituminous trade, and the outlook grows, if possible, more discouraging.